ACTA BIOLOGICA

ACADEMIAE SCIENTIARUM HUNGARICAE

SUPPLEMENTUM 1

PROCEEDINGS OF THE FIRST MEETING OF THE HUNGARIAN BIOLOGICAL SOCIETY

BUDAPEST, APRIL 26th—28th, 1956

AKADÉMIAI KIADÓ
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BIOLOGICAL RESEARCH IN THE INSTITUTE FOR PLANT BREEDING AND GROWING AT SOPRONHORPÁCS

K. SEDLMAYR

INSTITUTE FOR PLANT BREEDING AND GROWING, SOPRONHORPÁCS

An account is given of the research work carried on in the Institute, including a number of physiological, genetical and methodological problems of plant breeding.

The experiments conducted by A. KOVÁCS show the true role of the cuticular excretion in the resistance of various sugar beet varieties against the *Cercospora* leaf-spot.

Selective fertilization in mangel and sugar beet is studied by L. MAGASSY who has found the occurrence of most different cases of selectivity within the species *Beta vulgaris*.

MÁRTA CSAPODY and the author have shown that the role of temperature and light inducing generative development in *Beta vulgaris* is far more complicated than first believed on the basis of LYSSENKO's theory of phasic development.

Finally, the author is engaged in the study of the physiology and morphology of polyploid beets ; in his view, tetraploidy furnishes merely the starting material for further breeding work, he expects economically promising results in the first line from viable triploid hybrid varieties. When producing such hybrids, however, the breeder is still confronted with many difficult problems with cannot be solved but by the closest cooperation of workers in plant physiology, cytology, pathology and experts of seed propagation.

THE ZONAL PLANT ASSOCIATIONS OF HUNGARY

B. ZÓLYOMI

BOTANICAL DEPARTMENT OF NATURAL HISTORY MUSEUM, BUDAPEST

The composition of the earth's 1 : 1 000 000 scale vegetation map is being carried into reality as an effort of international cooperation. Since the sketchy outline maps of Hungary's vegetations have already been drawn, the composition of a 1 : 1 000 000 scale map to be drawn on the basis of internationally recognized points of view and principles, has seemed an up-to-date task to perform. From the dimensions of the scale it follows that only large plant associations or association groups, thus, first of all zonal plant associations (in an extended sense), can be marked. Soil zones as well as vegetation zones have formed themselves in accordance with the changes of climate and as a result of mutual interaction (Compare this with the notion "plakor".) Considering that some or other factor may have a more dominant part in the resulting sum total of effects, it is possible that several plant associations may be zonal under the some climatic zone or soil zone. The knowledge of the historical past is also necessary to the understanding of the formation and present distribution of vegetational zones, respectively zonal and extrazonal associations. The dispersion of the natural plant associations, especially of the ones on the Hungarian lowland (Alföld), can only be stated by means of reconstruction.

1. The zone of the forested steppe (Alföld, Kisalföld). The following associations are zonal on sandy soil; *Querceto-Festucetum* (sub-association *Populetosum albae* beside the Nyirség), *Querceto-Convallarietum* conditioned already by the mere fact of high soil water level, and the micro-mosaic of *Festucetum sulcatae danubiale* which varies in space and time according to the sand's movement (on humic sand, on rust brown forest soil, on blown sand covering old humus soil). On lime sand (calcerous sand) the transition in the mosaic is formed by *Junipereto-Populetum*. The following associations are zonal on loess sediment: the macro-mosaic of *Querceto-Festucetum* (with the transitions of *Prunetum tenellae*) and the *Festucetum sulcatae tibiscense** (on meadow soil), as well as, interzonally in transition to inundation area groves and alkali steppes, the mosaics of *Querceto-Festucetum pseudovinetosum* and of *Peucedano-Asteretum* (on the transition of meadows and swamp soil covering alkali subsoil). A large dimensioned azonal association is represented by *Querceto-Ulmetum* (on swamp and alluvial soil). A zonal forest is formed by *Querceto-Lithospermetum pannonicum roboretosum*** on the loess plateau of the "Alföld" border. (On degraded chernosem, on grey forest soil). Contrarilly to these associations which are rich in species and hybrides, the exclusive dominance of *Quercus robur* in the central and eastern parts of the Alföld mark also the growth of continentality here. (A similar situation is to be observed in the eastern part of the south Russian steppe.)

2. The zone of dense oak woods (Middle mountains, Transdanubia). Zonal associations: *Querceto-Lithospermetum pannonicum* (on brown or dark forest soil abounding in bases) in areas contacting the zone of the forest steppe, then, higher up, *Quercetum-Potentilletum albae* and *Querceto-Carpinetum* in different sub-associations and geographical variants (on more or less podsolic brown forest soil, or, in Transdanubia, also on rustbrown forest soil). *Querceto-Lithospermetum*, itself already extrazonal in the higher regions, is joined, extrazonally, by the micro-mosaic associations of the dry, warm, sloping steppes of the Middle Mountains (*Festucetum sulcatae pannonicum* being most characteristic here), and by the sub-mediterranean associations of *Quercus pubescens* (the majority extending to the rift of the Danube and thus *Querceto-Cotinetum*). (Most of these on redzina soil.)

3. The zone of beech woods (in isolated spots in the Middle Mountains but forming coherent areas in Transdanubia). The following associations are zonal: the different sub-associations and variations of *Fagetum silvaticae* (on mare less podsolic brown forest soil), *Querceto-Luzuletum* and *Luzulo-Fagetum* on silicious rocks (but only along the western borders and partly in the "Sátor" mountains; *Abieto-Fagetum* occurs as well on the "Irottkő" mountains on faded forest soil). *Dicarno-Pinetum* and others (on silicious faded grey forest soil), the plant associations of the North East European mixed forest zone, also occurs extrazonally in the "Őrség" area and on the "Vas" mountain ridge.

COENOGENESIS

M. Kretzoi

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Along with ontogeny and phylogeny, coenogenesis is the third element from which hologeny is built up. It is the science which deals with the evolution of coenoses.

Coenogenesis is not simply the history of floras and faunas, but the genetic evolution of the complex system of coenoses. As such, it is a paleontological science. For its methods it relies on the biological foundations of paleontology, but makes free use of the stratigraphical, chronological and faciological data supplied by geology.

It follows a double aim: first, it reconstructs the successive coenoses, linking them up into a continuous historical chain; secondly, it investigates into the laws regulating their evolution.

Departing from the aquatic and following the successive continental coenoses, this historical chain reaches from the beginning of the geological past to the present time.

* *Crambeto-Festucetum sulcatae pannonicum.*

** *Acereto tatarici-Quercetum pubescentis-roboris.*

The oldest aquatic multicellular coenoses of the lower Paleozoic were benthonic communities with a narrow nutritional range, planctonophagous, and of clumsy movement, or sessile. In the upper Paleozoic rapidly moving and actively macrophagous communities developed. Getting gradually to complexity in the Mesozoic, highly developed unarmoured nectonic organisms became dominant in the Neozoic.

Towards the end of the lower Paleozoic, emerging from the aquatic life milieu, the Arthropoda, the Vertebrata, and the Cormophyta invaded the continental living space simultaneously, to be followed soon by the long row of Molluscs, and for a long time all of them forming but short zoophagous chains of nutrition (which means that it had not been the plant that had made possible the invasion of the continent for the animal). Phytophagous Vertebrates did not appear until the Permian. The Tertiary, and even more so the Quaternary, reveal ever widening coenoses with nutritional chains of a definite tendency to shift towards phytophagy.

1. The coenoses of multicellular organisms proceed from planctonophagous short chains to ever more complex zoophagous chains.

2. Coenogenesis shifts from short zoophagous chains towards short phytophagous ones, with combined long chains in the middle.

3. The active nutritional chains generally shift from the macrophagous into the microphagous direction.

4. The trend of the evolution is from the well-protected, mostly sessile life forms towards rapidly moving forms of coenoses.

5. The production-biological development of the living substance proceeds on the direction of reduced losses and accelerated production.

6. As to phytocoenoses, tree and grass associations have gained in significance over the tree coenoses.

In coenogenetic research work it must always be kept in mind that the coenoses of the past are not identical with accumulations of fossil remains, and that they are best set against the actual coenoses under designation metacoenoses.

BIOLOGICAL BASIS OF FISH-PRODUCTION

R. Maucha

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In previous communications it has been suggested by the author that the organisms which are the primary producers and were formerly called briefly "producers", should be given the new designation "constructive organisms", because it is these that build up the organic matter required for the sustenance of the aquatic biocoenosis. The stock of the organic matter, P, comprises three components in accordance with the formula $P = R + F + V$, each of which is used up for a different purpose in the ponds. The first component, R, is stored up in the biomass, for its greatest part in the body of organisms which feed through the oral aperture after the manner of animals. The second component, F, is oxidized by the organisms to liberate the energy they need for the maintenance of their vital life processes. For the biocoenosis this energy is lost. Likewise lost is the third part of the organic matter, V, which consists of the lifelless organic substances contained in the remnants of dead, and in the excrements and secretions of living organisms, and undergo dissulution by the action of decomposing organisms (formerly called "reducers"). Were it now wished to apply this theoretically derived formula to carp breeding, account would have to be taken of two concepts introduced by Walter, viz., food lost directly and food lost indirectly. Food lost directly is that amount of organic matter which cannot be taken up by the carps because, according to Demoll, it is inaccessible to them. It is evident that the denser the population, i. e., the greater the number of carps in quest of food is, the less must be the amount of food inaccessible for them, and that therefore the direct loss is inversely proportionate to the density of the population. Moreover, food lost directly is not only no loss to the lebensraum, but it is none to the carps either, contrary to the opinion of Walter and Demoll, because it consists of living organisms which continue to propagate during the breeding season and thus replenish the food supply of the carps. On the other hand, food lost indirectly is lost definitely to the lebensraum and, of course, to the individual carps aswell. Besides, unlike food lost directly, it is proportionate to the density of the population. On these grounds, in its application to carp breeding the above formula can be

transformed by simple mathematical considerations to read: $nr = h = P - \frac{a}{n} - nf$, where n denotes the number of carps settled per unit of area, r the gain in weight of individual fish during the breeding season, and so $nr = h$ expresses the yield, $\frac{a}{n}$ the amount of food lost directly, nf that lost indirectly. Dividing both sides of the equation by n, we obtain $r = \frac{P}{n} - \frac{a}{n^2} f$, which expresses the gain in weight per carp. Applying the rules for calculating minima—maxima to the first equation, we find that the yield has at n_0 population a maximum, at which $\frac{a}{n_0} = n_0 f$, wherefrom $n_0^2 = \frac{a}{f}$ or $n_0 \sqrt{\frac{a}{f}}$; this means that there must be an n_0 optimal population, with maximum yield. This is the case when direct and indirect losses become equal. Theoretical support is thus afforded for WALTER's results obtained experimentally in the fish ponds at Viellenbach, and for those of ERŐS at Buzsák. Applying the same calculation to the second equation, it is found that the gain in weight per carp attains a peak at $n = \frac{2a}{P}$ population, whereof the direct loss $\frac{a}{n} = \frac{P}{2}$. Thus, there exists a maximum individual gain of weight, a body weight beyond which the carps cannot grow, having reached the limit of their capacity to consume food. This capacity is the amount of food which the carps must take up to gain the maximum weight. If we denote this maximum with r_{max}, we can write for capacity: $k = r_{max} + f = \frac{P}{n_1} - \frac{a}{n_1^2}$, as the fish, besides the matter to be stored in their body, have also to consume an f amount of food for maintenance. Since according to what has been said above the carps cannot feed at full capacity, unless the amount of food at their disposal is at least $\frac{P}{n_1} - \frac{a}{n_1}$, the maximum gain of weight therefore cannot be attained at the optimal population n_0 (because $n_0 > n_1$). On the other hand it is not only attainable with the population n_1, but also at a larger one. Namely, as has been pointed out above, the nutritive organisms, lost directly, do not represent a dead loss to the aquatic lebensraum, but due to their natural multiplication they even decrease the loss, and thus the population appropriate to attain the maximum gain in weight, is shifting towards n_0, but it does not reach this value. The question now is: how far does this shift go? We know the highest yield is at the population n_0. It follows that on both sides of n_0 there must exist an infinite number of populations, with pairs of identical yields. It means that, $P - \frac{a}{n_1} - n_1 f = P - \frac{a}{n_2} - n_2 f$, whence $n_1 n_2 = \frac{a}{f}$. We have, however, seen that $\frac{a}{f} = n_0^2$, so $n_1 n_2 = n_0^2$. Multiplying this equation by n_1, we ultimately obtain that $n_1 \sqrt{\frac{n_2}{n_1}} = n_0$, i. e. the optimal population. On multiplying this equation by r_0, the gain in weight at the optimal population, we can write $n_1 \sqrt{\frac{n_2}{n_1}}\, r_0 = n_0 r_0 = h_0$, which means that maximum yield is obtained in all populations, provided the gain in weight $r = \sqrt{\frac{n_2}{r_1}}\, r_0$ lies between the limits of r_{max} and r_0. If $\sqrt{\frac{n_2}{n_1}}\, r_0 = r_{max}$, then $n_1 = \frac{n_0 r_0}{r_{max}}$, as $\frac{n_0^2}{n_1}$ can be substituted for n_2. In this case n_1 is the limit sought for the population at which the maximum gain of weight can still be attained. Beyond this limit the rate of gain in weight begins to diminish; below it there is only the capacity to curb individual growth, but beyond it a struggle for food sets in as the shortage of available nutrients prevents the animals from consuming at full capacity. This is why the weight per carp sinks below the maximum. The yield nevertheless remains optimal until the population increases to n_0, as despite the decreasing rate of gain in individual weight the equation $n_1 \sqrt{\frac{n_2}{r_1}}\, r_0 = h_0$ remains valid. It ceases to hold good, when the population passes beyond n_0; yield drops then rapidly. The above theoretical considerations would appear to enable us to exploit fully the productive capacity of our fishponds, simultaneously supplying the market with fish of the required size and weight; they also facilitate the economical production of so-called retained stock, i. e. stock suitable for the purposes of continued breeding.

RESEARCH PROBLEMS CONCERNING THE FAUNA OF HUNGARY

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In Hungary, the science of zoology roots in the 18th century. The first period of its history ended at the turn of the present century with the publication of Fauna Regni Hungariae, this comprehensive manual dealing with about 30 000 species and their habitats, which was the laudable outcome of the unremitting efforts, at first, of a number of independent lone workers, not infrequently amateurs, and later, of generations of scientists attached to the National Museum of Hungary. In the first half of the 20th century, research work, carried out with modern means of collecting, continued to disclose a number of details and prepared the ground for zoogeographical synthesis ; moreover, the coenological trend, so conducive to enquiries into animal life, began to make its appearance. But along with the numerous achievements concerning details, comprehensive group monographs have faild to come forth, with the exception of one. Zoological research was given a fresh impetus after the country's liberation, when the Hungarian Academy of Sciences has made it one of the central tasks of biological work in Hungary to explore the animate bodies of the country as exhaustively as possible, and secoured the funds required for it.

Today, faunistic research in Hungary centers in the Zoological Department of the National Museum of Hungary, the Institutes of Systematic Zoology of the Universities in Budapest and Szeged, and in the Institute of Zoology of the University of Debrecen, but noteworthy results are being produced in the various high schools and research institutes of agriculture, hygieny, etc., as well. Wherever carried out, all investigations are integrated to serve a common end. In 1953 a resolution has been passed by the Zoological Committee of the Academy laying down that during the second Five-Year-Plan a survey of the entire animal life of the country is to be compiled and published under the title "The Fauna of Hungary". The work, planned to comprise 22 volumes, is to be a publication of the Academy's Publishing Office, and is to appear serially, each independent fascicle treating of a family or order in the form of "descriptive keys of determination".

This work, which is to be completed in the next few years, decides the details to which the individual organization have to devote attention, and is a guide in training our future specialists and defining their status.

The number of areas which could be said to be zoological *terrae incognitae*, is dwindling in Hungary, but the fauna in most of them is still known insufficiently. Systematic collecting is required to embrace the whole of the country, and complex expeditions must be sent out to explore lesser known territories. Spelaeology is promising of many interesting findings, and a field that has been completely neglected, but must at once be taken up, is animal life in the large rivers, the Danube and the Tisza. No aspect must be suffered to pass unimproved, if the new work is to give a complete picture of the Hungarian fauna, reliable throughout.

Expecting the Protozoa and certain groups of "worms", in Hungary specialists are available for practically every faunal field, but to increase their number and to secure replacement from the ranks of the new generation are vital problems that await urgent solution.

Systematic research is bound to bring many significant findings to light. Since our existing periodicals — Acta Zoologica Academiae Scientiarum Hungaricae, Annales Historico-Naturales Musei Nationalis Hungarici, Folia Entomologica Hungarica and Állattani Közlemények — are unable to supply the rising professional demand, an additional faunistic journal needs soon to be started.

THE STRUCTURE OF CARDIAC GANGLIA

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On the evidence of investigations of the cardiac ganglia carried out with the methods of BIELSCHOWSKY and GROS, and BIELSCHOWSKY and ÁBRAHÁM, in various fishes *(Cyprinus carpio, Sylurus glanis)*, amphibians *(Rana ridibunda, Salamandra maculosa)*, reptiles *(Varanus griseus, Tropidonotus natrix, Emys orbicularis)*, birds *(Columba domestica, Cygnus cygnus, Gallus domesticus, Ardea cinerea, Pelecanus onocrotalus)*, mammals *(Sus scrofa domestica, Canis familiaris, Epimys norvegicus)*, and human subjects, it appears safe to make the following statements.

The cardiac ganglia constitute an essential part of the intracardial nervous system. They vary in position, number, and size, but in respect of structure there is fair agreement between the groups.

In fish, the cardiac ganglionic system consists of two parts connected with each other. One is the chain system, which is made up of the cells that spread from the sinus venosus to the initial section of the ventricle, and of parallel-running fibres; the other is the large-celled elongate ganglion of loose consistency, to which in both the atrium and the ventricle ganglion cells are attaching singly and in groups.

In amphibians, the intracardial ganglia are confined to the right atrium and the partition wall between the two atria, where they form the three known, rather extensive, groups of ganglionic cells.

In Sauropsida, mammals, and humans, the ganglia come to fall within the atrial areas. Their number is particularly great in the right atrium, and still fairly considerable in the left. The cardiac ganglia of mammals and man are large-sized; in masses they occur chiefly in the right atrium where the large veins open into the heart. Besides, there are ganglia along the ASCHOFF—TAWARA node and next the coronary sinus.

Structurally, the cardiac ganglia are largely the same, except for the following differences. In fish, they are really plexuses of loose texture, without any individualized ganglia in them. In amphibians, Sauropsida, and mammalians, they are agglomerations of nerve cells in well-defined connective-tissue capsules, and with aboundant smaller heaps of cells attached to them. In the atrial myocardium of reptiles there are many solitary nerve cells, which in form and structure reflect the vegetative cell type.

In the lower groups the nerve cells are for their greater part unipolar. In the cardiac ganglia of the Amniota the multipolar forms are dominant, but unipolar forms also occur, and bipolar nerve cells are not uncommon either. In the heart of the mammals, especially of the pig, numerous unusual cell forms are encountered. The cleft bodies and leaflike dendrites suggest that it must have been some degenerative processes that had given rise to these cells.

There is no central terminal reticulum in the ganglia ; the contact of the cells with one another and the preganglionic fibres is synaptic. Among the interneuronal synapses, beaded terminals end bulbs, single and double rings, pericellular baskets, spirals, and long parallel surface contacts are frequently seen.

Cholinesterase activity which, though in varying degrees, is demonstrable in all the ganglionic cells, affords support for the assumption that preganglinary colinergic fibre terminals, differing in volume and system, attach themselves to the cells.

The histochemical studies made of the intracardial ganglia of fishes and mammals appear to favour the postulation of some neurosecretory processes taking place in the ganglionic cells, since the cells have proved to be GÖMÖRI-positive. The various vacuoles of homogeneous contents appearing in masses in the cardiac ganglionic cells of reptiles, likewise speak for neurosecretion.

THE SIGNIFICANCE OF DIMENSIONAL CONDITIONS OF SYNAPTIC CONTACT SURFACES

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In a few types of neuromuscular and interneuronal synapses, the relations between morphological and functional properties of the synapse have been studied. It has been found that (1) the area of the surfaces of contact between the two articulating elements, (2) the distance of these surfaces from each other, and (3) the nature of the substance filling the gap between them, are essential factors.

1. To be able to appreciate correctly the significance of the area of the synaptic articulation surface it is important to distinguish the "true" from the "apparent" surface of contact. The true surface is characterized by the presence of so-called "synaptic granules". The probability of impulse transmission increases in direct proportion to the size of the true-surface area.

2. In several types of interneuronal synapses there is a definite gap demonstrable between the neurofibrillary differentiated parts of the articulated neural elements. According to the conception predominant today, this gap is filled up with modified glial tissue (on the periphery with SCHWANN cells) ; from this, a number of authors has deduced that these tissues have an essential

part in impluse transmission. Based mainly upon his studies of ciliary ganglia, the author denies the existence of real synaptic gaps. In his view, their presence is merely an artefact due to the use of silver impregnation methods ; it arises because these methods leave unstained the "synaptic granules" located chiefly in the pre-synaptic surface.

3. The author gives some details concerning the structure and histochemistry of, and the part presumably played in the function of the synapsis by, the peculiar substance which is. interposed between the plasmatic parts with neurofibrillary differentiation of the two articulating elements.

THE SIGNIFICANCE OF AMITOSIS AND MULTINUCLEAR CELLS IN TUMOUR GROWTH

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It is common knowledge long since that mitosis offers no explanation for the exuberant proliferation of tumour cells. The trouble is not that the mitotic count is fairly low in the tumours (generally from 2 to 7 per cent), but that it is not proportionate to the rate of proliferation. In tumours of the most marked exuberance (melanoblastoma, sarcoma made up of polymorphous cells) there are scarcely any mitoses, or none at all, and they are frequently absent even from the sites where proliferation is most rampant.

Author's investigations show that amitoses and giant cells are encountered scattered over the florid parts of many speedily proliferating tumours. In some instances their appearance can be traced to the fact that the tissue from which tumour is derived is also replenished by amitosis (muscular sarcoma, cancer of the liver, chorionepithelioma), but in others there is no evidence to attribute the formation of multinuclear cells to physiologic regeneration (melanosarcoma, glioblastoma multiforme, sarcoma made up of polymorphous cells, etc.). Amitoses and giant cells are further encountered in the most rampantly proliferating parts of the tumours, i. e., in the rows of basal and suprabasal cells and in the epithelial bands infiltrating the environment. They are also found in the regressive areas of tumours and in their vicinity. Finally, the few-celled initial forms of metastases adjacent to, and more remote from, the cancer invariably start proliferating as multinuclear giant cells.

A short time after the action of chemical agents or X-ray irradiation the normal mitoses vanish and deformed mitoses (cacomitoses) make their appearance, sometimes in numbers exceeding two or three times the mitotic count of untreated tumours. Simultaneously, multinuclear and giant cells present themselves in growing numbers (occasionally attaining 50 to 70 per cent of the total number of cells) and survive for a fairly long stretch of time; on abandoning the administration of the drug, they gradually disappear and the structure of the tissue becomes normal again. This fact is of significance from more than one point of view. First, there is much to support the idea that these cells are of considerably higher resistance to repeated doses of the drug than either cells in interphase or dividing cell forms. Secondly, tumours pretreated in this manner have proved to be excellent objects in which to study the formation of amitoses and multinuclear cells. Lastly, the temporary appearance and disappearance of these cells make it seem probable that they might retransform into tumour cells capable of division.

Mainly provoked by the discussions following the publications of LEPESHINSKAYA, wide-ranged investigations are in progress in the Soviet Union concerning the biological significance of amitoses. In fact, this is at present the most controversial point in cytology. By Soviet biologists the view which assumes the continuity of the chromosomes is said to be a metaphysical view, to which western biologists adhere to be able to defend the theory of the continuity and invariability of the genes. Soviet scientists contend that on cell division the chromosomes cease to persist, the nucleoprotein passes into an inordinate state, chromosomes disappear and re-form.

There exists a similarly sharp contradiction in respect of the interpretation of amitosis. According to the authors in the West, in intermitosis and interphase the chromosomes pass into a state, in which they are invisible, yet persist unchanged. Inside the membrane enclosing the nucleus, retained in this invisible state, there may be halving of chromosomes (endomitosis), the same as in mitosis. This explains why in conformity with JACOBJ's law the nuclei double in size prior to division. The formation of new nuclei following fragmentation, disintegration, etc. of the old nucleus is to be regarded as a sign of regression. Markedly functioning cells divide regularly by amitosis.

The dialectical standpoint rejects the continuity of chromosomes. Besides regular amitosis, Soviet authors describe several morphological forms of non-mitotic cell division : the arising of new nuclei consequent upon the breaking down, fragmentation, sprouting, of the old nucleus, the formation of septa inside the nucleus, etc. To confront endomitosis, they have evolved the concept of endoamitosis. The salient point is their assumption that the nucleoproteid dispersed in the protoplasm conglomerates at one place into a cell nucleus.

Up to the present time, tumour growth has mainly been studied in individual cells or ascitic tumours, which are very good objects, but cannot be regarded as of full value in oncological studies. Apart from the oncological aspect, inquiries into the growth and proliferation of tumours will probably help us acquire a more detailed knowledge of the forms of amitotic cell division. It is well to keep in mind that an indispensable prerequisite of such studies is the following up of the process, and that for this no satisfactorily reliable methods are as yet available. For the time being, cinemicrography seems to be the most serviceable.

Abstracts of papers read at the sessions of the section for experimental zoology, biochemistry and physiology

CHANGES IN THE STRUCTURE OF THE SPLEEN ON ITS EXCISION IN SUCCESSIVE GENERATIONS

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Splenectomy has been performed on the 9th day of life in 12 successive generations of albino rats, and the reactions of the spleenless organisms have been studied. The present paper is only concerned with the structural changes in the spleen itself. The alterations in the splenic structure consequent upon splenectomy in successive generations have been found to be of abiding character. They manifest themselves in a lessening of the white pulp and an increase in the number of the myeloid elements. A major rise in the number of giant cells originating from these element, adds to make the cytologic picture conspicuous. The nucleic acid of the cells is diminished, the quantity of mucopolysaccharides increased, particularly in the framework of the spleen and in the giant cells. The smooth muscle elements become less, the elastic elements more, numerous.

The experiment points to the ability of the spleen to act upon the whole organism and thus, through the gonads, upon the germ cells. This indicates that a role is being played by the spleen in the correlations between organs, though it is as yet not understood exactly.

Comparing critically his own experimental findings and the ontogenetic and philogenetic data in the literature, author comes to the conclusion that the lymphatic component of the spleen is evolutionally a fairly late acquisition, and therefore still labile.

Finally, the paper shows up the advantages that can be derived from coupling, and utilizing jointly, experimental findings and evolutionary histologic evidence.

EFFECT OF 3,4-BENZOPYRENE ON FRESH-WATER MUSSELS

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On the evidence of the author's earlier experiments, mussels are greatly dependent on ciliary activity, related to conditions of oxidation, for their capacity to clear water. Applying a specially elaborated method, *Dreissena polymorpha*, each weighing 0,5 g, were injected in the visceral sac with 0,0002 mg, and *Anodonta cygnea*, *Unio pictorum*, and *Unio tumidus*, with 0,001 mg of 3,4-benzopyrene. The effect of this agent on the water-clearing capacity was measured in water turbidified with starch and carmine, by comparing it with that obtained in control experiments and blinds. The transparency test, evolved earlier by the author, was used in establishing the rate of turbidity. The final findings were that while in the control experiments all mussels cleared the water in from 9 to 11 hours, the treated *Dreisseina* cleared it barely and the other test mussels not at all, in the first 24 hours; in fact, *Dreissena* required time until the evening of the second day, and the other test animals until the morning or noon hours of the

fourth day, to clear it completely. Obviously, the differences are wide enough to make safe the conclusion that benzopyrene decreases water-clearing capacity. Benzopyrene injections thus seem to exert a marked influence on ciliary activity, in fact, on the whole metabolism of the mussels studied. The method therefore appears suitable for studying certain aspects of the effect carcinogenic substances exert on the whole organism.

EXPERIMENTAL STUDIES OF THE DESTINY OF SPERMATOZOA NOT PARTICIPATING IN THE FERTILIZATION PROCESS

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The intention of the work described was to obtain additional data concerning the destiny of, and the possible effects exerted by, spermatozoa which have found their way into the female organism but do not participate in the process of fertilization. The most prominent morphological evidence of the direct effect of these cells on the cells of the uterus has been subjected to a critical study. According to the recent work of GENIN, this evidence consists in (i) that the spermatozoa of a great variety of animals is capable of penetrating by active movement into the uterine wall and divers tissues, and (ii) that the male germ cells that have got into the tissues and the cells of those tissues mutually act upon one another ; cytologically this manifests itself in a coming off or melting away, as it were, of the anterior part of the head of the spermatozoa.

The present authors' attempts to verify this evidence have failed. It has been found that (i) the spermatozoa's getting into the uterine tissue is an artifact produced while preparing the sections for the histological examination, and that (ii) the change that has been regarded as the cytological manifestation of the interaction between cells is likewise the consequence of the technique applied in serial sectioning. Under these circumstances, the special relationship between the uterine tissue cells and the male germ cells continues to remain an open problem.

Human and rat spermatozoa were injected intravenously to albino rats, and were found to be taken up by the organs of the RES (lung, liver, spleen, kidney). This confirms that the cells of a phagocytic type are responsible for the disappearance of the spermatozoa which do not participate in the fertilization process.

Experiments are in progress to clarify the effects exerted by, and the significance of, the acidfast lipoid fraction present in the spermatozoa.

MORPHOPHYSIOLOGICAL STUDIES ON RODENTS CONCERNING THE EFFECT OF LIGHT AND DARKNESS FURTHER THE FEMALE OESTROUS CYCLE

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In the experiments reported, 43 male and 72 female white mice were divided into three groups and studied in different seasons of the year. The animals in the first group were exposed daily for 1 to 15 minutes to the light from a quartz lamp, those in the second group were kept in darkness throughout the experimental period, while the mice in the third served as controls.

In male mice the microscopic structure of the tissue in the thyroid gland showed that irradiation with quartz light decreased the activity of the gland. Although it was less pronounced, this decrease was expected in view of the results obtained in some earlier experiments by one of us in the dove. The season of the year is apparently not without influence on the effect quartz light exerts on thyroid action, for in experiments carried out so far it asserted itself less in April than in February. Permanent darkness affected thyroid action in that it increased the latter in relation to the controls, but again not without influence by the season. In the anterior lobe of the pituitary body of the male controls basophil and scattered acidophil cells represented the chromophil cells ; in that of the animals exposed to quartz irradiation there occurred acidophil and basophil cells in varying proportions ; in that of the mice kept in darkness acidophil cells were predominant. In the adrenals, upon the effect of quartz-light treatment for

not more than three weeks, the nuclei in the zona glomerulosa decreased and in the zona fasciculata either remained unchanged or slightly increased in diameter, in relation to the controls. Histochemical examination of the cortex showed reduced contents of lipoids, cholesterol, and ascorbic acid, which were only demonstrable in the zona glomerulosa. On the other hand, on irradiation lasting for a longer period (two months) the entire cortex became saturated with lipoids and cholesterol. On these grounds the present authors suggest that short-period irradiation intensifies action in the zona fasciculata but diminishes it in the zona glomerulosa, while long-period treatment decreases it in the entire cortex. The suprarenal cortex of the animals kept in darkness was similar in structure to that in the controls. Once again seasonal differences made themselves felt : irradiations in summer failed to be of effect on the adrenal structure.

In female mice, whether treated with quartz light or kept in darkness, the structure of the thyroid and pituitary glands revealed, in dependence on the phase of the oestrous cycle, the same picture as is characteristic of the individual phases on the evidence of earlier studies made by the authors. Accordingly, thyroid action was lively in pro-oestrum and oestrum, less so in the metoestrum, and of medium intensity in the dioestrum. As regards the action of the anterior lobe of the pituitary body, it was marked in the oestrum, slightly diminished in the metoestrum, while in the dioestrum the degranulated cells regenerated and the cells that had perished due to liquefaction were replaced ; in the pro-oestrum the hypophyseal action became lively once more. Besides, in the thyroid structure of the female animals the various effects of the different treatments did not fail to manifest themselves, although they were slight in relation to the males. On comparing the structural alterations, in the thyroid and pituitary glands of the same animal, whether male or female, authors found that they, together with the structural peculiarities characterizing certain functional changes, were in complete coordination. The adrenals of the female mice irradiated with quartz light likewise showed the changes in dependence of the phases of the oestrous cycle : the X zone was absent in the pro-oestrum and the metoestrum, always present in the oestrum, and alternately present or absent in the dioestrum. The effect of the quartz light manifested itself invariably : the zona fasciculata was wider in the treated than in the control animals ; at the same time, the cellular nuclei in the zona glomerulosa were smaller in diameter in the irradiated than in the control mice. The authors' conclusion is that from among the climatic factors the presence or absence of light exerts a major effect on the structure and activity of the endocrine glands studied.

QUANTITATIVE AND QUALITATIVE ADAPTATION

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Intensified functional stress gives rise to a thickening of the stratified squamous epithelium of the skin of the palm ; tnis phenomenon, known as activity hypertrophy, is regarded as one of quantitative character, as it involves a merely quantitative change in the differentiation of the same quality of tissue. In the same category belong the phenomena of disuse atrophy, where the identical type of tissue is wasting away (e.g. stratified squamous epithelium, muscle, bone). These changes arise only upon functional stimuli which vary in intensity but not in quality. The question presents itself, what biological reaction would be the response of the organism if, instead of a quantitative change in the functional stress that acts upon the living tissue, we were to apply an altogether new qualitative functional stimulus. This question had already been posed by ROUX, who assumed that a qualitatively new function was bound to bring forth a qualitatively new tissue, but has failed to verify his assumption either by data based upon positive observations or by experimental results. Unable to substantiate this conjecture experimentally, BENNINGHOFF rejected it as basically erroneous. Yet, by applying adequate, qualitatively new biological functions at certain sites, the writer and his co-workers have found it possible to induce the organism to give rise to qualitatively new types of tissue at the sites in question. More than ten in number, these tissues include hyaline cartilage, collagenous connective tissue, tendon, fibrous cartilage, smooth cartilaginous articular surface, synovial fringes, whole joints, elastica, epithelial adiposis, epithelial keratinization, etc.

The present paper describes a case of qualitative adaptation which was not elicited experimentally, but was an adaptation of the organism in the strict sense of the word, where the ends of a human ulna fractured in the middle third became adapted to each other by the formation of a true joint in response to stimuli of pressure and lateral displacement acting upon them during the process of healing (flexor—extensor synergism, supination—pronation, load).

The cancellous bony tissue showed a finished structure and the bone surfaces were covered with hyaline cartilage of a fibrous nature (about the same as is seen in the sternoclavicular joint).In sections, freshly formed well-developed synovial fringes were visible underneath the articular capsule. In the course of the adaptation process, in this case without experimental interference, a spongious bone substance — instead of a compact one — was formed, which merely meant a difference in structure, — while in the middle third of the ulna cartilaginous articular surfaces, a joint capsule, and synovial fringes were formed, the three last-mentioned growths representing tissue qualitatively new to this site. But the joint as a whole, too, is a new growth at this site, and may be regarded as a complex supportive organ made up of different kinds of tissue.

The case described in this paper affords evidence for the fact that in response to appropriate biological stimuli the organism is capable of adaptations by means of the formation of tissues qualitatively new to the respective sites. It also exemplifies that in the human organism there does occur qualitative adaptation accompanied by the formation of locally new tissues.

ADRENAL DEVELOPMENT IN HYPOPHYSECTOMIZED CHICK EMBRYOS

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The effect exerted by the embryonic pituitary on the structural differentiation of the adrenal gland has been studied in 9 control and 10 hypophysectomized chick embryos.

In their experimental approach to the problem the authors departed from an earlier observation, namely, that the appearance, on the eighth day, in the cells of the embryonic pituitary of an appreciably quantity of the impregnable substance which indicates glandular activity (Szentágothai and Székely), coincides with the appearance of the double-refracting substance in the adrenal gland (Dawson) and with the time at which it is possible to demonstrate the ACTH contents of the pituitary with biological methods (Székely, Endrőczi and Szentágothai). Hypophysectomy was performed partly by electrocoagulation of Rathke's pouch, partly by decapitation. Histologically, complete removal of the pituitary was controlled in serial sections of the head while the structure of the adrenal gland was evaluated by the following means.

1. In the control embryos the adrenal cells began to arrange themselves into readly distinguishable islets as from the eighth day, but in the hypophysectomized animals this process began on the nineth or tenth day only and was less conspicuous.

2. The nuclei in the adrenal cells were in the whole 1 μ larger in diameter in the hypophysectomized than in the control embryos.

3. The mean proportion of mitotic to normal adrenal cells (with 6000—8000 cells per count), was for the control embryos 0,47% on the 7th, 1,25% on the 8th, 0,89 on the 9th, 0,71% on the 10th day, and for the hypophysectomized embryos 0,59% on the 8th, 1,16% on the 9th 1,19% on the 10th, and 1,31% on the 11th day. Accordingly, while in the adrenal gland of the normal embryo structural differentation begins on the eighth day, hypophysectomy significantly retards the process, as is indicated first of all by the greater size of the nuclei and the protracted high proportion of mitotic cells.

INVESTIGATIONS CONCERNING THE HYPOTHALAMIC REGULATION OF THE HYPOPHYSEAL-ADRENAL SYSTEM

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There are several data in the literature concerning the hypothalamic regulation of the hypophyseal-adrenal system, but as regards localization no uniformly accepted view has as yet developed. Our earlier experiments carried out with a large number of animals have delivered evidence that in the rat the most forceful impediments to the activization of the hypophyseal-adrenal system are lesions in the medial part of the supraoptic region (n. suprachiasmaticus, n. filiformis and n. paraventricularis). The object of our present investigations was to throw light upon the mechanism of the phenomenon.

In the experiments 345 inbred albino rats of 150 g average weight were used. Two reactions were employed to test the hypophyseal-adrenal system for activization. Eosinopenic reactions were elicited with 50 μg of adrenalin injected subcutaneously and 2,5 to 5,0 μg administered with the aid of a stereotactic apparatus directly to the pituitary, 0,1—0,2 – 1,0 I.U. of ACTH given intraperitoneally, and 400 to 500 g of cortisone given subcutaneously. The drop in the ascorbic acid of the adrenal gland was tested with adrenalin applied subcutaneously (300 g) and administered directly to the pituitary (2,5 to 5,0 g), further with ACTH injected intraperitoneally (0,05 I.U.).

It has been found that after a hypothalamic lesion, not only the adrenalin given subcutaneously, but also that reaching the pituitary gland directly, fails of effect. This finding appears to preclude any supposition that in animals with a hypothalamic lesion the adrenalin cannot find its way into the hypophysis because of vascular injuries. Our observation affords support for the idea that adrenalin attacks at a point in the central nervous system.

Also, it has been found that in animals with a hypothalamic lesion, the eosinopenic and the reduced-ascorbic-acid reactions due to the action of exogenous ACTH, are likewise significantly inhibited. On the other hand, upon the action of exogenous cortisone, the same animals give normal eosinopenic reactions, despite hypothalamic lesions.

This last finding is an argument in favour of a change in the sensitivity to ACTH taking place in the adrenal gland of animals with hypothalamic lesions.

RESPONSE OF THE DOG TO INTRAVENOUS SALINE

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According to data in the literature, in the dog, unlike in man, the first response to saline infusion is intensified glomerular filtration followed by increased excretion of sodium and water. By the evidence of a series of investigations, filtration as measured by inulin clearance shows no appreciable intensification after saline infusion, unless diuresis and, in connection therewith, filtration were at a very low level in the control period preceding infusion. If in the control period diuresis was more than 0,3 ml/min/m^2, the rise in the rate of filtration after infusion will not be significant, but excretion of Na and water will increase by several hundred per cent.

On experimental evidence, in oliguria inulin clearance cannot be regarded as the true measure of filtration, because clearance measured in the usual way gives only a fraction of the real value obtained by direct determination of the renal plasma flow and by inulin extraction. The higher rate of filtration associated with diuresis is but an apparent one.

Accordingly, in the dog, the same as in man, the enormous increase in excretion of Na and water, which follows the swift intravenous introduction of saline corresponding to 3 or 4 per cent of body weight, is due primarily to a reduction in tubular reabsorption.

Where 8 to 14 hours earlier the dog had been prehydrated by the intravenous administration of 30 ml/kg 0,6-per cent NaCl, excretion of so-called free water was observed after the saline infusion, in addition to the moderate rise in filtration and the enormous increase in Na excretion mentioned above. In other words, in the prehydrated dog, just like in man, isosmotic hypervolaemia elicits inhibition of ADH secretion and, thus, excretion of osmotically free water.

INVESTIGATIONS INTO THE EVOLUTION OF THE PITUITARY-ADRENOCORTICAL SYSTEM

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On the basis of studies carried out concerning the pituitary-adrenocortical and lymphatic system of various animals, authors reached — from the point of view of comparative endocrinology — the following conclusion.

1. In experiments performed in man, dog, cat, rabbit, guinea-pig and rat, relationships — characteristic of the species — were established between the adrenocortical activity, the drop of the lypmhocyte count owing to different stresses, the weight of adrenal and the spleen.

2. In the ontogenetical development of the pituitary-adrenocortical system of different species great differences were found in relation to the pre- and postnatal period. It was suggested that these differences are in close connection with the development of the vegetative reflex-system of each species. In chickens the ACTH activity was observed already in the egg of 8—9 days, while it appeared in new-born rats only 8—10 days after birth. In mammals the development of humoral adaptation and that of the vegetative regulation by the central nervous system show a close paralellism.

RECENT INVESTIGATIONS INTO THE FUNCTIONAL POLARITY OF THE RETINA

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Previous experiments of the author concerning optic reflexes after variously oriented transplantations of the eye-anlage of *Triturus vulgaris* embryos led to the conclusion that the functional polarity of the eye-anlage is earlier determined in the antero-posterior than the dorso-ventral direction. Other experiments, in which microlesions were induced in the region of the tectum opticum, have furnished proof that, once they are functionally determined, optic neurons cannot establish functional contact in the tectum opticum except with similarly determined nerve cells, even in the case of an inversely oriented transplantation of the embryonic eye-anlage.

In this latest experiment, author halved the embryonic eye-anlage in the dorso-ventral plane before definitive functional determination of the dorso-ventral axis had taken place (st. 25). By fitting together the two free poles of the remaining nasal (or, in some cases, temporal) half, he was able to produce an eye-cup half the size of the original one, which, with antero-posterior axis reversed, he then transplanted to the site of the contralateral eye-anlage of another embryo. The nasal (or temporal) pole of the remaining half of the eye-anlage came to occupy a reversed position; the opposite pole was formed by the fusion of the functionally undetermined originally superior and inferior poles. Optic reflex tests, performed after the development of vision, proved that the functionally undetermined half opposite part of the functionally determined nasal (temporal) half of the eye-anlage developed a temporal (nasal) character. After an eye-anlage had been cut in two along the antero-posterior plane, and the folded lower half transplanted, the nasal and temporal eye-anlage portions forming the new upper pole were observed to retain their original functions. The author draws from these experiments the conclusion that the already determined specific character of any pole of the eye-anlage is able to induce a corresponding opposite specific character in any undetermined tissue of the same anlage when situated opposite to the former. In analogy to our present concepts of morphological determination of other organs the author thinks that the specific biochemical actions which are probably at play behind the process of determination, take an essential part also in the embryonic formation of nerve connections.

THE BASIC PROCESS — IN THE MUSCLE — OF THE CONVERSION OF CHEMLICAL ENERGY INTO WORK

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In recent years, progress in muscular biochemistry has been conspicuous chiefly fo achievements in experiments concerned with the contractile muscle-models. These experiments have left little doubt that the phenomena which are observed to take place on the interaction of actomyosin gel, actomyosin filament, and extracted muscle fibres on the one hand, and ATP on the other, rest upon the same physicochemical process; further, that the same basic process underlies muscular function in vivo, which manifests itself in the operation of models. However, remarkably little progress has been made in clarifying the question as to what constitutes the essence of the common basic phenomenon, i.e., of the interaction between the actomyosin and ATP.

Departing from the functional role of the adenosinepolyphosphates in building up actin and from the conception that in some phase of muscular functioning, the phosphate bond energy is bound to be transferred on to the protein structure the present authors have adopted for working hypothesis that the conversion of energy, i.e. its transference from the small-molecular compounds to the protein structure, takes place through the intermediary of the adeinnucleotide bound to the structural proteins. Accordingly, they assume a cyclic phosphorylation-dephosphorylation and/or exchange of the structure-bound ADP.

To the former experimental findings of the authors that the protein-bound nucleotide characterizes every muscle, and nothing else but muscles, have found new support in the fact that one of their recent studies on a tissue (the medulla of the adrenal gland of the horse, this medulla containing even more ATP than the muscle), failed to reveal any trace of bound nucleotide.

In conclusion, the authors describe a procedure which, by combining adsorption on active carbon and paper chromatography in a single operation, makes it possible to analyse the bound nucleotides of about 2 g of muscular tissue for ATP, ADP, and AMP. Experiments to demonstrate with this method the assumed functional changes in the bound nucleotides are in progress.

EXCHANGE OF POTASSIUM AND PHOSPHORUS ISOTOPES IN THE ACTIVE MUSCLE

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Ion exchange in the active muscle was studied on sartorius preparations in Ringer's solution containing K^{42} and P^{32}, after several hours of work done at room temperature. On the one hand, the muscle at rest was compared with its directly or indirectly stimulated pair, on the other hand, the directly and indirectly stimulated muscles were compared. In the latter experiments the two parallel muscles were always stimulated in identical electric circuits.

The muscles were dried and incinerated in the electric oven. From one part of the solution of the ashes, after evaporation to dryness, radioactivity was determined, in an other part chemical microanalysis was performed. From the data obtained in this manner the specific activity was computed, and this was then used to draw conclusions.

As regards K, during the experiment lasting for about 4 hours, (i) approximately 20 per cent of potassium of the resting muscle was found to exchange against the potassium of the surrounding normal Ringer's solution, and (ii) the directly stimulated muscle was observed to lose a considerable amount of potassium (in accordance with earlier results in our Institute) while, at the same time, the specific activity of the potassium increased by roughly 30 per cent in relation to the indirectly stimulated parallel muscle.

Concerning the P exchange, the results obtained were similar in principle.

Significance seems to attach to these results in research of the fundamental phenomena of stimulus.

THE MECHANISM OF FLUID MOBILIZATION AND OF CONCENTRATION WORK IN BIOLOGY

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In living organisms the passage of substances proceeds either through semipermeable membranes or in extracellular and intracellular spaces, respectively.

Thermoosmosis offers a good explanation for the transport of substances through a semipermeable membrane. The phenomenon was studied in subsequent model experiments; a semipermeable membrane was prepared with lipoid solution. Just like in earlier experiments made with protein, it has been found that, provided it is warmer, the more concen-

trated solution is capable of diluting the less concentrated one, if this is cooler. Since similar structures or temperature gradients are also encountered in living cells (glands, roots), it is thought that a part might be played by the same mechanism in biology, in the passage of substances through membranes.

As regards the concentration work in cellular spaces, this might be related to thermal diffusion, respectively capillary-thermodiffusion. If in the gap there is some kind of a solution, and the two opposite walls differ in temperature, then the solution is more concentrated near the cooler wall; or, if the walls are of the same temperature, but the solution is in flow, then — and this is capillary-thermodiffusion — it becomes cooler and of higher concentration in the middle, and warmer and more dilute on the margins. In biological objects, both are possible (e.g. in intercellular spaces, loops of HENLE, etc.).

EARLY CHEMICAL PROCESSES OF MUSCULAR AND NEURAL ACTIVITY

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The first aim of the investigation was to decide the fundamental question, whether the energy necessary to perform muscular work, will be released just under the action of the stimulus liberated from chemical sources, or it stays ready for use in potential form, accumulated during relaxation and repose. The frist possibility would be proved, if the decomposition of makroerg phosphates: adenosinetriphosphate (ATP) and creatinephosphate (CP) ("P-ergens", "pergens") appeared already at the very outset of contraction. Progresses in methods in the last years seemed to have facilitated experiments, apt to resolve this question. The results obtained up to present are, however, contradictory, proving alternately one of the opposite possibilities.

A difficulty of previous investigations was that, for the fixation of the momentary chemical state of the muscle, only deep-freezing was available wich provokes, by itself, contraction. To meet this difficulty, a chemical method has been elaborated, in which, after curarization, a 10 per cent sodium hydroxide is used. Following homogenization, neutralization and trichloracetic deproteinization, in the filtrate first anorganic (+ CP) phosphate was determined, as also the P which is liberated by 10 min hydrolysis and corresponds to the sum of ATP and ADP (both by photometrical hydrochinone method of JENDRASSIK and HORVÁTH, CP was determined by the modified method of ALEXEJEVA).

When one of the sartorius muscles of *Rana esculenta* was kept at rest, while producing a 1—5 second tetanus in the other (contralateral) horizontally kept unloaded muscle, by stimulating it with a 50 Hz frequency, the pergen values were found to be identical on both sides. This proves, that decomposition does not set in if no tension is produced or work performed.

If, on the other hand, the muscle, loaded with a weight of 30—50 g was stimulated either isometrically or isotonically, even a tetanus of 0,5 seconds was found to be sufficient for a notable ATP and CP splitting (1—1,5μM/g) as compared to the state of rest. During tetani of 2 seconds with a musclar performance of about 200 g cm/g muscle (recorded on a kymograph), the decompositions were about 2—2,5 μM/g musc., amounting to a total of approximately 45—50 mcal, the decompositions of CP being in it mostly greater. Therefore contraction in itself causes no decomposition of the "pergens". On the contrary, it becomes even in a few tenth of a second very considerable, and increases with time, if the muscle exerts force and performs work. The same must be valid also for a twitch.

A further object of the investigations was to determine the components of the changes occurring during the performance of work. While a considerable decomposition of pergens is induced even by a passive loading of the muscle, the extent of decomposition is about three times as large, if it exerts active force. In order to determine the amount of energy corresponding to a performance of work, the muscle of the one side was first loaded and immediately afterwards stimulated (this muscle had thus to perform a certain amount of work by lifting the load), while the muscle of the other side was first stimulated, i. e. brought into tetanus, and then loaded. Both these experiments were performed on numerous animals, and the values thus obtained were compared also with their states at rest. In the case of the above-mentioned work performance (4,7 mcal), this amount is liberated both from ATP and CP, so that the total value of released energy is twice as much. Therefore the "net" useful effect is 50 per cent. But exertion of active force causes a breakdown some five times greater, in which mostly that of CP predominates. In experiments with indirect stimulations (on non-curarized ischiadicus-gastrocnemius prepara-

tions) a further surplus of decomposition appears, even without tension- and work performance approx. 10 mcal/g in 2 sec) and points to a splitting of pergens in the end-plates. Taking this also in account, the "gross" useful effect becomes rather low, not more than 13—15 per cent. Examining the restitution after passive stretching it is found that the (CP) is more quickly recovered, and within a minute it may even rise above its resting level.

Considering that also the cerebrosides of the myelin sheath take part in the axonal flow, authors are making investigations to elucidate the role played by the sugar component of these lipids in neural and muscular activity and trophical effects.

THE SIGNIFICANCE OF ELECTROMETRY IN THE STUDY OF BIOLOGICAL PROCESSES

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Since in systems containing living cells the rH, computed with due regard to the redox potential (RP) and the pH respectively, is characteristic of the metabolism, it is suitable to give a general impression of the state of the system. The curve which demonstrates the changes in the RP or rH is indicative of the direction of the metabolic processes, and can therefore be used as an indicator in many tests, particularly in microorganic cultures. Thus, on the basis of the direction of the redox curve it was possible to determine the trace-element requirements of microorganisms, and from the results of corrosion tests the material could be decided which it is most expedient to use in building fermentation equipment. With the aid of RP measurements, it was possible to determine with great precision the presence of such exceedingly small quantities of antibiotics as, for instance, $10^{-7}\mu g$ of penicillin, and the resistance of microorganisms to antibiotics. Further, by interpreting the redox curve on the basis of metabolite formation it proved possible to establish its so-called productive phase, and by artificially protracting that phase, to raise considerably the production of a number of therapeutically important metabolic products, e.g., ergosterin, riboflavin, and streptomycin. Redox systems derived from the same or from other organisms were used in prolongating the productive phase. Besides knowing the RP, which governs the thermodynamic conditions, it is important to know the physicochemical and biochemical processes that give rise to it, and an equally essential factor in directing metabolism is the redox capacity of the system. Thus, for instance, it has been found that upon the action of ultraviolet or X-rays, changes take place in the RP and redox capacity, respectively, of bacterial nutrient media. It has also been established that, by inhibiting the PASTEUR effect and enhancing carboxylase production, thioglycolic acid, which increases the production of ergosterine in yeast, shifts the metabolism in the direction of producing alcohol and synthetising lipids. Interpretation of the redox curve has led to the solution of the problem of continuous fermentation. It was the redox curve that has made obvious the earlier tendency of breaking up into phases continuous fermentation processes. It was the redox potential that has been found to be the suitable means by which to render the individual phases stationary and to control the speed of the process, because, as a well-defined thermodynamical concept, the redox potential expresses the resultant of all the processes taking place in the culture. On employing the continouos method controlled with the aid of the redox potential it is possible to interfere with each individual phase, e.g., to introduce precursors at the right time and place. In this manner, in addition to securing the advantages of the continuous process, an improvement in production can be achieved. For instance, an increase of 50 per cent has been attained in producing riboflavin by the continuous process.

A STUDY OF THE PHASES IN INDUCTIVE ENZYME FORMATION

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It is known from the work of POLLOCK that there are three phases distinguishable in the inductive penicillinase synthesis of *Bacillus cereus* NRRL-B-569 strain, namely, 1. the period of the specific binding of the penicillin, lasting for 1 to 5 minutes ; 2. the latency period preceding the true protein synthesis, lasting for 15 to 25 minutes ; 3. the period of the actual

enzyme synthesis, depending for its lenght on the presence or absence of the free substrate (penicillin).

Having studied these phases experimentally, the authors have come to the following conclusions :

1. The specific binding of penicillin is unconditionally dependent on the intactness of the cells. Owing to a competitive mechanism, binding can be temporarily suspended by the previous addition of ascorbic acid.

2. During the latency period ribonucleic acid synthesis occurs, the duration of the process depending on the quantity of nucleic acid precursors present.

3. For the phase of protein synthesis itself the induced bacteria do not have to be intact ; the protoplast fraction alone is capable of performing it. Not only the actual kinetics and duration of penicillinase formation, but its energy requirement is also different according to whether there is free penicillin present or not.

THE MITOSIS-STIMULATING EFFECT OF HOMOGENIZED TUMOUR CELLS

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The experiments were performed on mice 9 days after the inoculation with EHRLICH ascites tumour. They received intraperitoneally the identical quantity of supernatant of homogenizates (2 g wet weight per 10 ml of isotonic KCl) of EHRLIC ascites tumour cells (from a 9 days old inoculation), of JUHÁSZ—KENDREY—BALÓ amytal ascites sarcoma cells (from a 6 days old inoculation), of the liver of untreated adult mice and adult rats respectively. The animals of the control group were injected i. p. with isotonic KCl. Smears were taken from each experimental and control animal at the beginning of the experiment, as well as 4, 8, and 24 hours after the treatment, and stained according to FEULGEN. Counting 2000 cells in each smear, the mitotic rates were computed. On comparing the mitotic numbers of the individual group it was found that in the animals treated with homologous ascites carcinoma the number of mitosis increases gradually, to attain in the 24th hour 138 per cent of the count at 0 hour. On the other hand, in the animals injected with amytal ascites sarcoma cells or mouse or rat liver, the mitotic number, after an initial decrease, stayed at approximately the same level, similarly to the control animals. This observation agrees in part with that made by LETTRÉ in his earlier investigation of like nature.

A HISTOCHEMICAL STUDY OF DEHYDROGENASE ACTIVITY IN ASCITES TUMOUR CELLS

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Employing triphenyltetrazolium chloride, the dehydrogenase activity of EHRLICH ascites carcinoma and JUHÁSZ—BALÓ—KENDREY amytal ascites sarcoma has been studied and its changes have been followed up in experiments with tissue cultures.

It has been found that using glucose as substrate, enzyme activity per cell after incubation for 90 minutes was $2{,}3 \times 10^{-7}$ g for ascites carcinoma, as against $4{,}1 \times 10^{-7}$ g for ascites sarcoma. A further difference between the two types of cells manifested itself in the extent to which the substrate could be used, particularly succinate and tyrosine. The distribution of the formazan granula, too, differed. The granules accumulated in a large part of the plasma are more minute in sarcoma than in carcinoma. Culture experiments carried out in horse serum, chick embryo juice, or glucose, showed that in ascites tumour cells dehydrogenase activity lessened roughly in proportion to the number of dead cells (SCHREK's staining) and to the rate of degeneration as ascertained from the cytological picture.

These experiments seem to indicate that the TTC reduction offers a sound basis to judge the vitality of ascites tumour cells.

A STUDY OF SOME ATYPICAL FORMS OF CELLULAR REPRODUCTION*

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It has been observed on several occasions, and successfully followed up by means of cinemicrography that during the otherwise normal mitotic division of connective-tissue cells, relatively large portions of plasma temporarily detach themselves, with only narrow bridges of plasma remaining to connect them with the cells. The mitosis completed, these apparently separating portions again melt into the plasma of the arising daughter cells. In stained preparation the phenomenon gives one the erroneous impression that plasma is being untied during division. It is similar to the apparent untying of plasma in oxygen-deficient dividing cells.

In a culture explanted from the thymus of a new-born rat, a reticuloepithelial cell was observed transforming by endomitosis into a binuclear cell, which three hours later divided into two uninuclear cells. Another reticuloepithelial cell fell into three parts, by two smaller portions of the nucleus becoming untied and detaching themselves, each with an adequate portion of plasma. Obviously, in this latter case an asymmetrical amitotic division had taken place. In a cell from GUÉRIN carcinoma another asymmetrical triple division could be observed, but in this the division was by chromosome formation.

A study of their motion seems to justify the conclusion that the daughter cells derived from these unequal triple divisions have gone through that "rejuvenation" which is known to occur in normal divisions, for the two smaller cells move considerably quicker than the larger third one ; this indicates that "age" has been inherited by the latter. On this evidence it would appear that all divisions in two or more parts, symmetrical or asymmetrical, invariably yield such offsprings of which one only inherits those varied marks of age that signify death at a certain period.

CHOROID PLEXUS AND SENIUM

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Employing the usual histological methods, the choroid plexus of 92 human subjects, one 32-year old cow, and two dogs of 17 and 18 years, respectively, was examined, paying attention primarily to the sclerosed plexus. Proliferation of connective tissue, varying in degree, was observed in the plexus of every individual past 65 years of age. It invariably involved a decrease in the number of capillaries. In the sclerosed villi the epithelial cells were flattened. Sclerosis of the plexus was found to bear no direct proportion to age ; while in a patient of 84 it was barely perceptible, and in another of 62 there was no trace of it at all, it was very marked in a subject who died of hypertonia at the age of 28. Practically no proliferation of connective tissue was observable in the plexus of the 32-year old cow and the two aged dogs. Accordingly, sclerosis of the plexus cannot be regarded as a "senile" phenomenon.

No parallelism at all was found to prevail between the degree of sclerosis in plexuses and the so-called senile phenomena observable in other parts of the nervous system (capillary fibrosis, lipoidosis in nerve cells, glial proliferation, senile plaques, ALZHEIMER's "Fibrillveränderung"). While in several instances grave senile lesions to the nervous system were accompained by a barely perceptible degree of sclerosis in the plexus, in others a markedly sclerosed plexus was encountered in a nervous system with hardly any senile phenomena in it. Thus, the choroid plexus appears to display in some measure an independence of the so-called senile lesions.

As regards the pathogenesis of plexal sclerosis, it is thought probable that due to the pathologic changes in the permeability of the capillaries, initially pericapillary oedema presents itself, which is rich in protein and in which there arise connective-tissue fibres ; these are at first argyrophil, collagen formation taking place but later. This means that sclerosis of the plexus is really a problem of permeability. It is similar to RÖSSLE's "Organsklerose".

If of considerable intensity, sclerosis of the plexus involves a decrease in the number of villi and thereby in the size of the active epithelial surface. By several authors, the dizziness and headache experienced by aged people in changing their posture, is brought into relation with the

*Address accompanied by microfilm presentation.

diminution in the pressure of the cerebrospinal fluid which is connected with the phenomenon described. In a number of persons in the senium, a major quantity of the cerebrospinal fluid was let off and the subjects were made to move about instead of lying. It was found that lumbar puncture was readily endured by people in the senium. This is contradictory to the above anatomical findings and the assumption made. Obviously, further systematic studies are required concerning the pressure of the cerebrospinal fluid and the permeability of the "barrière" in the senium ; later histological examinations of the identical plexuses are likewise needed.

CHANGES IN THE "PSYCHIC" STRUCTURE IN OLD AGE

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In analysing psychological phenomena authors follow the principles of the school known as structuralism, which, they hold, is more natural and simpler, and less laden with speculation, than atomistic psychology. In their view psychic phenomena arrange themselves in three structural strata : (i) the perceptional structure, (ii) the attitudinal structure (reflecting one's emotional attitude to the world), and (iii) the adaptational structure (comprising one's pattern of behaviour as a whole). In the course of life there arise within the individual structures, but also in between them, stereotypes of a dynamical nature whose function it is to allow the higher processes of the nervous system to pass off at the least possible expenditure of energy. It is these dynamical stereotypes which in man promote exquisite synthesis of the activity of the nervous system. With life advancing in age, they gradually lose their dynamic nature and become ever more synthetic but at the same time more and more stereotypic. Finally, in old age a psychic state presents itself, which is peculiar to that age and characterized for new impressions, but at the same time accompanied by such positive values as a great capacity for abstraction, a wide intellectual horizon, a calmed and level outlook. Thus the line of development appears to proceed from the accidental to the regular and commonplace, respectively.

In a number of cases senile dementia, particularly in its early phase, is not accompanied by a real loss or deterioration of the mental faculties. Therefore, the authors' conception of it is analogous to that of BLEULER concerning schizophrenia : on finding that dementia praecox is not associated with dementia he changed its name to schizophrenia. The same as, in the view of many workers, hebephrenia is the decompensation of pubertal crisis, so is senile dementia the decompensation of the normal senium, with a tremendous part played in it by exogenous factors. This view is not contradicted by the irreversibility of the syndrome ; the less so as hebephrenia commonly likewise entails irreversibility. In the second phase of the syndrome attention is centred upon the dynamical stereotypes. Since these have lost their dynamic power and turned brittle, the regressive process does not involve their dissolution but their breaking off in fragments, and this fragmentation revivifies the infantile mechanisms of the earliest childhood. The psychic occurrences become, one might say, decapitated. Arteriosclerosis is then merely a causal accompaniment, like tuberculosis in hebephrenia.

Summing up, normal senium is a psychological developmental process, while senile dementia is the specific and independent syndrome of this phase originating from the "decompensation" of the senium.

Abstracts of papers read at the sessions of the section for zoology, paleontology, anthropology and hydrobiology

COMPARATIVE INVESTIGATIONS CONCERNING SOME SCARCELY-KNOWN OR MISINTERPRETED MUSCLES

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Departing from anthropocentric considerations in their comparative myological investigations, a good many authors have arrived at erroneous conclusions regarding homologies and terminology, since they failed to take into account those deplacements and shifts which constitute an important factor in the evaluation of individual muscles and occur in consequence of deviations from upright carriage, i. e. orthoskelia, or are induced by reductions in the number of digits, further by modifications of the gait towards a plantigrade, digitigrade or unguligrade manner of walking, as also by the use to which certain muscles are put. It is obvious that, to be able to establish correct homologies between muscles, it is not enough to be rather guided by the results of ontogenetic and innervational investigations, since every myomere has its corresponding neuromere. According to HECKEL, those are homologous organs which have similar origin. The present lecture had the object of publishing the results of investigations made by the author in respect of some scarcely-known or misunderstood muscles in the foreleg and thorax of certain Ungulata, Carnivora and Rodentia.

The *musculus interflexorius* (PITZORNO) is one of the less-known muscles : of the animals examined it is only the horse from which it is absent (nor do we encounter it in man). In ruminants, pigs and carnivora, this muscle connects the flexor digitorum superficialis with the flexor digitorum profundus as *m. interflexorius proximalis* on the carpus and *m. interflexorius distalis* on the metacarpus (only the latter to be found in carnivorous animals). It is muscular in young animals, and sinewy in old ones. It is not homologous with man's variable *musculus palmaris longus*, nor with the *m. palmaris brevis* or the muscle of man's *hypothenar* : while these muscles are innervated by the nervus ulnaris, the m. interflexorius is supplied by the nervus medianus.

The *m. interosseus medius* of the Equidae is called upper levelling ligament also : although it develops into a muscular, very strong sinew in the foetus, it still retains muscle fibres for some time. Anatomically, it is a flexor of the pastern, arising from the coalescence of two flexor digitalis brevis profondus muscles. Innervation by the nervus medianus.

The *m. extensor digitalis communis* of the Solidungula which corresponds to the *m. extensor digitorum communis hominis* may be called a common digit-tensor inasmuch as, besides having a terminal tendon to stretch the third digit. two more tendons detach themselves from it on the metacarpus, one of belonging to the THIERNESSE-muscle which corresponds to the m. extensor indicis propius, the other to the PHILLIPS-muscle which corresponds to the m. extensor digiti IV ; they originate from the caput ulnare and the caput radiale of the common digit-tensor, respectively.

The presence of the *m. pronator teres* can be demonstrated also in those domestic mammals in which radius and ulna have immobile insertions : muscle fibres, demonstrable in the frontal aspect of the ligamentum collaterale radiale in 30 per cent. of developed Equidae, point to this fact ; immobilized, the muscle fibres, present at the beginning, become suppressed by the passively-acting tissue elements during extrauterine life (allobiosis, ROUX).

The *pectoral muscles* of animals vary according to the shape of the thorax : the *m. pectoralis major* of humans is smaller in ungulate, carnivorous and rodent animals than in man, while

that muscle which corresponds to the pars humeralis (ascendens) of man's *m. pectoralis minor* is very considerably developed in animals (in the horse, it may reach a weight of 4 kg). The first to appear in the embryo is the pars clavicularis (descendens) of the superficial pectoral muscle ; it is from this that the *m. subclavius* becomes detached : in ruminants, this muscle runs from the 1st—2nd fusion of costal cartilage-costal bone to the tendinous inscription of the m. brachiocephalicus which corresponds to the clavicle. Ruminants have no pars praescapularis, it being — according to MARTIN — represented by the m. subclavius.

The transverse muscle of the ribs, i. e. the *m. transversus costarum*, is misunderstood and incorrectly termined, for its fibres, a continuation of the m. rectus abdominis, have not a transversal but a longitudinal course ; position, course and innervation of the *m. sternalis*, regarded as a variation of the m. pectoralis major, would make it correspond to this muscle, but it would be also justified to call it m. rectus thoracis.

Of the muscles which support the ribs, it is the *m. scalenus medius* that has developed in all domestic mammals : dorsally to the arteria subclavia, it runs as m. scalenus primae costae from the pleuroapophysis of the 3rd—7th cervical vertebra to LISFRANC's tubercle, the m. scalenus albini being separated from it by the plexus brachialis. Ventrally to the arteria subclavia, we encounter the m. scalenus anticus both in rabbits and humans : it is absent from all other domestic animals. On the other hand, the m. scalenus posticus vel supracostalis runs from the posterior tubercles of the 4—6th cervical vertebrae along the outer surface of the 4—8th ribs (this muscle, too, is missing in horses and sheep). The scaleni are homologous with the intercostal muscles.

IXODIDS OF HUNGARY AS VECTORS OF INFECTIOUS AND PARASITIC DISEASES IN MAN AND ANIMALS

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Although it has been common knowledge for more than half a century that ticks are the vectors of the animal diseases known as piroplasmoses, which are responsible for severe losses, the work of several decades was required to show that these bloodsucking mites were also instrumental in the spread of other diseases infectious to animals and, in part, to man. In fact, it is but quite lately that light begins to be thrown on those intricate environmental, biocoenologic factors which furnish the key to the apparently paradoxical phenomenon that with the progress of civilization those human and animal diseases, which it is now customary to designate as natural focal diseases become more numerous. The increase in the number of diseases is of course relative and temporary, since no sooner is a new disease recognized than recognition itself offers the means whereby to set into motion its efficient control ; in other words, it really is the progress of civilization that enables us to reduce the adverse importance of a new natural focus.

In Hungary, ticks are vectors in the first line of piroplasmoses, in the second line, and much less frequently, of other infectious diseases. To the second group belong, apart from human viral encephalitis, such diseases as tularaemia, toxoplasmosis, and leptospirosis, the spread of which by tick vectors is as yet imperfectly known.

An important point is that of the specifity of ticks as vectors of various pathogens. Our knowledge in this respect does not extend, for the time being, beyond the Piroplasmids ; but from the little we know, it seems safe to conclude that in Hungary we need not fear the occurrence of some of the diseases spread by ticks, because the climatic conditions are unfavourable to the acclimatization of the vectors. Such are, for instance, rickettsial diseases, of which the vectors, the *Ornithodorus* species, do not occur in our country.

Whether a tick-spread disease does or does not occur in a country, whether it is sporadic or endemic, depends not only on the geographical distribution of the vector ; it is contingent on a number of environmental factors as well.

The paper concludes with a brief account of the condition prevailing in this respect.

PATHOLOGICAL AND MORPHOLOGICAL LESIONS IN STYLOPIZED INSECTS

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Stylopized insects, i. e., insects infested by a parasite of the order Strepsiptera, may display various changes : the inner sexual organs may become impeded in their normal development (parasitic castration), secondary infections induced by the parasite (mycoses, etc.) may arise, and changes in the morphological and ornamental characters of the host may take place. Three theories are current to explain these alterations. The mechanistic theory attributes the pathological lesions to mechanical factors such as pressure, or sites of reduced resistance in the integument of the host. According to the castration theory, the morphological changes in the host are due to castration brought about by the parasite and ultimately leading to sex reversal. The inhibition theory holds that biochemical impediments acting during the development of the morphological characters are responsible for the changes occurring in the latter.

The material of the Museum has been studied ; it comprised more than 500 stylopized insets belonging to 158 different species, 57 of which were unknown to the literature as hosts of Strepsiptera. The study revealed changes additional to those known from the literature. In the stylopized male of the fossorial wasp *Bemex oculatus* LATR., partial or total retrogression of the secondary sex characters (the serration of the femur of the middle pair of legs, and the tooth or plate projecting from the ventral plate of the 2nd and 6th abdominal segment) was observed. Four other hymenopteran species (*Bembecinus tridens* FABR., *Prosopis pictipes* NYL., *Andrena Schencki* F. MOR. and *Andrena scita* EVERSMANN) were conspicuous for differences in their pattern. Examination of these insect species revealed that their facial ornamentation (the distribution of light and dark elements) shows a tendency to assume features characteristic of the opposite sex. Empty male puparia failed to reveal mycosis, though it has been described in them by several authors. On the other hand, a fair number of puparia was seen to have closed after the emergence of the male imago and, in three instances, such puparia were found to be full of unicoloured sand grains of uniform size. Finally, serial dissection (263 specimens of *Andrea ovatula* KIRBY) proved that mere external examination of the host frequently fails to reveal stylopization (latent stylopization).

While, then, the inhibition theory seems to explain the retrogression of morphological characters in a satisfactory manner, a more intricate effect mechanism has to be postulated to account for changes in the pattern. This mechanism may consist either in a combination of various chemical (toxins) and mechanical (e. g., pressure) effects, or in the antagonistic action of a developmental factor, the intensity of which determines the efficiency of the action. The castration theory, on the other hand, seems to be quite untenable, since no evidence at all has as yet been provided for a true sex reversal due to stylopization, and experience accumulated so far shows the development of the secondary sex characters to be completely independent of the sexual organs or their developmental state.

Demonstration of the morphological and ornamental changes observed in stylopized insects, and of the possible existence of latent stylopization, is of great taxonomical significance, because these phenomena may lead, and actually have led, to errors in identifying hosts.

VIABILITY AND HETEROSIS IN FISH

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In the years 1951—1955, resistance to abdominal dropsy has been studied in "domestic scaled", "domestic mirror", and wild (scaled) carps, and their hybrids. The ponds, in which the experiments were carried out, were so heavily infected with ascites that 78,9 per cent of the fishes settled in them perished in the first year. The rate per cent, at which the one summer progeny settled in the ponds in the spring, survived up to the autumn fishing season, was regard-

ed as the rate of viability. In some years, the offspring derived from crosses were weighed, to see if there was any heterosis in body weight consequent upon intervarietal crossing. The survival rates of the offsprings of the crosses produced in 1951 and settled to fishponds in 1952, were as follows : 2,9% for W (wild) ♀ × Sc (domestic scaled) ♂, 0,4% for M (domestic mirror) ♀ × W ♂ 57,0% for W ♀ × M ♂, 5,8% for Sc ♀ × M ♂, and 6,3% for M ♀ × Sc ♂. These data reveal that the progeny of W ♀ × M ♂ survived in relatively high numbers, while, conversely, practically all the offspring of M ♀ × W ♂ perished. The higher resistance of the W ♀ × W ♂ offsprings is also proved by the fact that during the previous wintering, only 3,8% perished, as against 50% of the other variants and the standard carps in the ponds. In 1953, the survival rates were : 6,25% for Sc ♀ × Sc ♂, 17,3% for W ♀ × W ♂, 12,9% for Sc ♀ × W ♂, 0,74% for W ♀ × Sc ♂, and 0,9% for M ♀ × W ♂. These data show a relatively higher resistance in the W ♀ × W ♂ progeny. In 1954, hygienic conditions in the ponds being much better, 75,2% of the offsprings of Sc ♀ × Sc ♂ remained alive, 98,2% of those of W ♀ × W ♂, and 82,5% of those of W ♀ × M ♂. Again, the iffspring of W ♀ × W ♂ proved to be the most resistant. The hybrids of W ♀ × M ♂ were also found to be more resistant than those derived from crossings between scaled carps. In 1955, with the second generation at disposal, the offsprings of the W ♀ × M ♂ variant (in the following designated H) were crossed with each other, then backcrossed with M, Sc, and W, respectively. The survival rates were : 69,3% for H ♀ × H ♂, 51,7% for H ♀ × M ♂, 56,4% for H ♀ × Sc ♂, and 46,8% for H ♀ × W ♂. An interesting phenomenon is the higher resistance in the H ♀ × H ♂ offsprings than in those derived, for instance, from H ♀ × W ♂ ; the survival rate for the former was 69,3% as against 46,8% for the latter. Mother pairs were spawned to produce the hybrids.

According to these findings, pure wilds are the most resistant ; in fact, on settling them in the fishponds, the infective state of the latter was found to improve. Both in 1952 and 1954, the crossing of W ♀ with M ♂ produced offsprings so resistant that one is bound to think of heterosis in resistance ; the more so, as these offsprings considerably exceeded the others in weight as well.

In conclusions, our investigation have failed to disclose whether domestic mirror carps and domestic scaled carps do differ in respect of resistance to abdominal dropsy. Ultimately, they show that while some hybrids are more resistant than their parents, there are others which are in this respect inferior to their purebred progenitors. The intricacy of the question concerning hereditary transmission of the power to resist dropsy, is clearly shown by the fact that resistant offsprings resulted in greater numbers from intercrossing hybrids than from backcrossing hybrids with wilds.

THE SIGNIFICANCE OF LAND PULMONATE IN THE BIOLOGY OF THE PROTOSTRONGYLIDAE (NEMATODA)

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The sheep runs in Hungary, particularly those in Transdanubia, are fairly rich in land snails. These snails act as intermediate hosts of the various Protostrongylidae with which 55,7 per cent of our sheep are infested causing serious damage resulting from this situation.

On the evidence of recent studies it is claimed that all the land-snail species which are of most frequent occurrence in the Trandsdanubian sheep runs *(Helicella obvia, Abida frumentum, Theba carthusiana, Chondrula tridens, Zebrina detrita, Cepaea vindobonensis, Helix pomatia,* etc.) are equally suitable (obligatory) intermediate hosts to the Protostrongylidae lungworms of sheep. However, the part they play in transmitting the infection is not the same. In dependence on their particular oecological requirements, the individual species differ in regard to the contact which they establish, on the one hand, with the larvae of the Protostrongylidae (by which they are infested), on the other hand, with the sheep to which they transmit the infection. The most significant role is that of the small-sized species (e.g., *A. frumentum*) abiding in the bottom third of the grass, which are more strongly infected with larvae of Nematodes and sometimes taken up in large masses by the grazing animals.

Coenological studies of the snail fauna of our sheep runs are required if the epizootical significance of the individual land-snail species is to be established.

THE AGRICULTURAL LAND, IS IT A BIOCENOSE?

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The biocenose represents a community of interrelated groups of organisms, establishing itself gradually around photo- (chemo-) synthetic organisms and developing a physiographically defined unit of the biosphere. The groups of organisms or niches represent the structural elements of the biocenose and are interrelated in such a way that the presence of a certain niche gives opportunity for the joining of another which fact is, on the other hand, the preliminary condition for the joining of a following niche. In a biocenose there are at most six niches, viz. the niche of *producents* (organisms building up organic compounds and representing thus the main group of every community), the niche of *corrumpents* (organisms attacking living producents), the niche of *sustinents* (organisms which play an important role in maintaining the plant matrix as symbionts or in effecting the fertilization of higher plants), the niche of *obstants* (organisms attacking living animals), the niche of *intercalars* (organisms of scavenging habits taking possesion of organic compounds in lifeless form), and the niche of *reducents* (organisms the main role of which is to demolish organic compounds in inorganic ones). In every biocenose the ground plan of the structure is much the same and is represented by these niches. It is not essential whether these niches comprehend (in different communities) populations of the same species or of different ones : the backbone of the biocenose is represented by the food chain and the latter can be regarded as a system of the niches. Except producents and reducents, all the other niches contain both plant and animal organisms. The structure of the agrobiocenoses differs in no essential way from that of the natural biocenoses. The main difference between the two forms of communities may be: explained by the phenomenon that the activity of man throws obstacles in the way of the plant succession and that the main niche, that of the producents, is established by human beings. But such activity is not unfamiliar as far as the habits of certain animals are concerned ; on the other hand, Man — living in and from the agrobiocenose, utilizing it and modifying his environment essentially in the same way as other animal beings and with the natural consequences following this activity — must be regarded as a member of the closely interrelated population of this community, being unable to live without the agrobiocenose. Although the effects of the activity of Man are often drastic, the agrobiocenose is not only the result of human work, since there is the intervention of certain organisms (for example weeds, insect pests and so on) which may get foothold against the interests and will of Man. The agrobiocenose, however, appears as a biocenose, the "dominant population" of which is represented by the *Homo sapiens* L.

THE PART PLAYED BY THE MACROFAUNA IN DECOMPOSING FOREST-LITTER FLOOR

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Partly under natural conditions and partly in the laboratory, the total turnover of nutrients has been studied in *Diplopoda* and *Isopoda*, these most notable saprophagous *Arthropoda* in forest-floor litter. The present paper describes laboratory experiments involving two *Diplopoda (Glomeris hexasticha* BRANDT, *Chromatojulus projectus* VERHOEFF) and one *Isopoda (Protracheoniscus politus* C. L. KOCH*)*.

On the evidence obtained, only a very small part, from zero to 7 per cent, of the food ingested is built up into the organism. The measure in which food is utilized is greatly dependent on its quality. Of the dry matter in the litter from layer F_1 not more than 10 per cent, whereas of that in the litter from layer F_X sometimes as much as 20 per cent is oxidized while passing through the intestinal tract of the animals. From this it follows that, although the food consumed undergoes mostly mechanical breaking up only, in some cases the humification, in the chemical sense of the term, which takes place during digestion, is quite considerable. That this is so is borne out by experiments in which mustard *(Sinapis alba* L.*)* and oat plants *(Avena sativa* L.*)* were successfully brought up in excreta, indicating a fairly advanced state of humification. Although a chemical analysis found the nitrogen content of the excrements was substantial,

the mustard suffered in some degree from nitrogen deficiency ; this shows that decomposition is still far from being perfect.

Animals fed with litter leaves containing 50 per cent water, at temperatures from 16 to 22° C, consumed daily dry matter corresponding to from 0,5 to 4 per cent of their live weight. On raising the temperature within the said limits, food consumption rose rapidly. Given the identical conditions, the animals took up more food in the spring than in the autumn. Quantitative food uptake was found to be also dependent on the state of decomposition of the litter.

VAN DER DRIFT's investigations have shown that the quantity of litter consumed under identical conditions by individuals of different size of the animals in question, is proportionate not to body weight but to body surface. Accordingly, the quotient of the quantity of food taken up by any one animal in the unit of time and the body weight raised to the 2/3rd power, is a constant, independent of the size of the animal (VAN DER DRIFT's constant). According to the findings of the author the value of this constant is independent not only of the size of the animal but, in first approximation, also of the species to which it belongs. This seems to permit the conclusion that the food turnover in these species feeding on litter and being of the same life form, is essentially the same. This holds good even for animals taxonomically as remote from each other as *Diplopoda* and *Isopoda*. This fact greatly facilitates the right appreciation of the part played by the macrofauna in decomposing the forest-floor litter, because it enables us to infer reasonable precision, from the food uptake of arthropods of whatever species or size in a forest, the amount of food consumed by all the other species of a similar phage type living in that forest.

NESTING ASSOCIATIONS OF BIRDS IN HUNGARY

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Reliable evidence, covering roughly the last quarter of a century, puts the present number of nidificant bird species in Hungary at 192. These species nest not, of course, each in a separate area, but nidify in associations of more or less steady character. The present paper is an inquiry into the conditions that give rise to such nesting associations and determine their permanency. In a territory like Hungary, this is an intricate problem; yet, ultimately it was exactly the mosaic-like great variety in areal units, which ensured frequent repetitions, and thereby helped establish individual nesting associations of a more or less steady nature in which laws could be detected to govern the co-nidification of different species within the area. In Hungary, an additional difficulty in solving the problem lies in the fact that most of the country's regional units are cultivated units brought to their present level by human intervention of different degree. In its bearings on breeding birds, this degree of the intervention of man had to be determined for each individual cultivated region.

Basing himself on observations and theoretical considerations, author distinguishes the following 9 regional types within which different nesting associations are encountered in Hungary : woodland, meadowland, marshland, alkali soil, steppe, sand, rocky and loessland and cultivated land in the strict sense of the term. With the exception of two, these regional types display their special characteristics not uniformly over the whole area, but in various degrees ; and it is these subregions with the typical features differently pronounced, which constitute the hatching grounds of one or the other particular nesting association. The two exceptions, within which there are no subregions distinguishable, are each the breeding place for a single association only. Types which differ as habitats of nesting associations, may greatly resemble as landscapes. This shows that the apparent character of the landscape alone is not enough to guide one in determining the composition of an association ; it is but one of the factors on which that composition depends, and its significance is variable. The numbers of nesting associations per regional type are as follows : 13 woodland, 6 meadowland, 7 marshland, 2 alkaline land, 1 steppe, 1 sand, 2 rocky, 2 loessland, and 4 cultivated land : in all, 38 associations.

Among the species composing the association there is always a particular one which has best adapted itself to the hatching place typical for the association, wherefore this, the most permanent member, is regarded as the dominant species. The other species adapt themselves to the typical habitat or the other member species in different degrees, by which it is then possible to classify the associated species according to their importance within the group.

The paper finally discusses the relationships between the member species, which hold the association together, and deals with interconnections manifest between associations nesting in regions of kindred character.

QUANTITATIVE STUDIES ON THE PLANKTON OF LAKE BALATON

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Two series of plankton samples (1936—1938 and 1947, 1949, 1951) taken from four layers (0, 1, 2, and 3 meters) were investigated both qualitatively and quantitatively. Both the population density (number of individuals per liter) and volume of the members of the association were established for the different months, for the warm and cold water seasons, annually for all 6 years and calculated for the units of volume and surface of the water body. A rough estimate was also made for the entire lake. From these data the following observations can be recorded : 1. Corresponding to the optical properties of the shallow lake (its mean depth being 3 to 4 m) a stratification in population density occurs in the daytime. This condition, however, is disturbed by various environmental factors. 2. Coenoxenic members of littoral and benthic origin are nearly always present in the open water. 3. In the course of the three successive years of 1936 to 1938 a change in the systematic structure of the plankton could not be observed, though a difference in the population density, a continuous increase in some members of the plankton took place. This change might be due to the normal annual fluctuation of hydrographical and meteorological conditions in the environment. 4. A plankton invasion *(Mougeotia)* in 1944 very likely caused by war conditions affecting the lake, marked a significant change in the plankton from trophical point of view : a sudden rise in the stock of certain forms (e.g. *Ceratium hirundinella*, etc.) coincided with the appearance of forms previously not recorded. 5. An extremely low water level lasting for several weeks (1949) combined with increased evaporation had an unfavourable effect upon the population density of some members of the plankton. 6. The figures also show numerical relations between the biomasses of the phyto- and zooplankton (number of individuals, volume). 7. Using data from G. ENTZ on the connection between the frequency of fission of *C. hirundinella* and the temperature of water, a calculation was made on the daily production (and loss) of organic matter (as being represented in the body of *C. hirundinella*) during midsummer. The following results were obtained (in mg/m^3) : 31 to 53, 53 to 88, 85 to 141 and 552 to 918, for July in the years 1947, 1949, 1951, and for September, 1951, respectively. 8. These data cast light upon the intensity of the rate of production and of circulation of matter in the lake during midsummer. These conclusions were drawn from data on *C. hirundinella*, the biomass of which form has undoubtedly the highest value of all the other groups of the phytoplankton. This mass of organic matter, because of its high rate of population dynamics is subjected to a vigorous and continuous change within the stock in midsummer, which affects the environment, and might therefore be considered a limnical phenomenon. 9. Rate of the population dynamics of some pelagic Crustacean as well as the chemical composition (food value) of the Crustacea plankton in relation to seasonal and physiological conditions is being investigated at present in our department of the Biological Research Institute at Tihany.

INVESTIGATIONS INTO THE CONDITIONS OF NUTRITION, GROWTH AND RESPIRATION OF VARIOUS KINDS OF FISH IN THE LAKE BALATON DURING THE WINTER SEMESTER

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More than 500 fishes were subjected to examinations concerning length, weight, age, quality and quantity of intestinal contents, and reproduction (proportion of sexes, weight of roe, number of eggs, etc.). Besides a small number of other fish, our examinations were chiefly concerned with shads *(Pelecus cultratus* L.*)*, bleaks *(Alburnus alburnus* L.*)*, the *Rutilus rutilus* L.

and pike-perches *(Lucioperca lucioperca* L.*)* The catch supplied us mostly with shads of the group-ages II to IV ; specimens of a higher age are rare. Of individuals with equal length, slenderer shads were found to be young, while the stouter ones were mostly older animals left behind. Young, two-summer shads (agegroup I) consume a great amount of plankton even in winter, while older animals consume less in this season. From October to December, a great part of the food consists of *Leptodora kindtii* (FOCKE) of which sometimes 1000 to 1400 specimens were found in a sample of intestinal content, further open-water Copepoda plankton, insects fallen into the water, and small fishes. In winter, empty intestines are not infrequent. Towards spring, nutrition becomes more abundant (plankton, small fish). It is interesting that, 48 hours after the death of the fish, it was possible to hatch in water several hundreds of Copepoda eggs taken from the anal portion of the intestinal content. The development of the different generations of shads shows annual variations. Sexual maturity is reached sometimes by the third, sometimes by the fourth summer. In the course of ripening, the eggs change their colour from blue through violet, beige and yellow to orange. Number of eggs about 200 000 per kg of body-weight.

Apart from small insects fallen into the water, plankton constitutes the principal nutriment of the bleak. Neither *Leptodora* nor small fish were demonstrable in the intestinal canal. The *Rutilus* takes abundant food during winter ; empty intestines were encountered towards spring only. The composition of the food undergoes considerable changes during the half-year. In October, it consists in the main of algae and certain mollusks. In November and December, masses of larvae of the 15 to 22 mm-long *Chironomus plumosus* were consumed, this kind of food not having been demonstrable either before or after this period. Towards spring, the food is again the same as in October. Breams *(Abramis brama* L.*)* also took abundant food in the examined period. It consisted chiefly of bottom-fauna (principally larvae of the *Protenthes punctipennis* KIEFF). Perches take little food in winter (mostly *Acerina cernua* L. and the young of their own species). The average weight of food taken up was, with reference to body weight, this : shad 0,14%, perch 0,54%, bream 1,10%, *Rutilus* 1,19%.

Conditions are not unfavourable to the survival of fish in the Lake Balaton during winter. Water is highly oxygenous under the ice ; owing to assimilatory processes, oxygen concentration may reach a level of 120 to 150%. It is practically impossible for fish to perish through lack of oxygen in the Balaton. As a consequence of intensive photosynthesis, the icesheet includes gas bubbles, especially near the shore. Chemically, these bubbles have almost the same composition as air.

A STUDY OF THE FOSSIL MADREPORARIA OF HUNGARY IN THE SYSTEM OF LIFE PHENOMENA

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The statistical evaluation of research work extending over eleven years underlies the present paper. In Hungary fossil corals (Madreporaria) have been found in layers from the Lower Carboniferous, Lower and Upper Permian, Middle and Upper Triassic, Lias, Dogger, Titonian, Neocomian, Cenomanian, Senonian, Lower, Middle, and Upper Eocene, Oligocene, Helvetian, and Tortonian. The numerical distribution of the genera and species appears to confirm that differentiation into species was most marked in the Triassic and Eocene periods. Among the fossil Madreporaria in Hungary, dominant were generally the suborders Montlivaltiida, Turbinoliida, and Fungiida. From among the others, a few families were confined to a single period each. Most of the stratigraphical species were in the Upper Permian, Upper Ladinicum, Upper Cretaceous, Upper Eocene, and in the Tortonian stage. The only possible explanation for this is that the adaptive capacity of the coral organisms is more developed and stabilized by the end of the periods. Exceptions to this are only encountered in the Triassic and the Cretaceous, where the curve displays a steep drop towards the Noric, while in the Cretaceous its branch ascending from the Jurassic culminates in the Hauterivian stage, whence there is a drop down to the Cenomanian. For this the fact accounts that the periodicity in coral evolution does not invariably coincide with the limits as fixed by us.

The present statistical study is based on the careful examination of 531 species in 214 genera. The phylogenetically primitive, ancient, median, new, and modern types were all found to occur in this material from Hungary. Their succession, their limit values and linkages could be

readily followed from period to period. The most pronounced bank formations in this country occurred in the Upper Permian, Ladinicum, Noric, Neocomian, Senonian, Eocene, and Tortonian. Conservative (persistent), adaptive (elastic), and progressive-regressive species were encountered in varying numbers. The manifestations of adaptive life were the most strongly marked from the Jurassic onwards in the Cretaceous and the Eocene. QUETELET's mean was represented by the elastic species.

In Madreporaria the ontogenetic and phylogenetic form equivalence are labile. Their constitutional peculiarities are still imperfectly understood. Functionally, the phylogenic succession of adult individuals displays the influence exerted by the orogenic and epirogenic geological phases. This is revealed in that the appearance of the said phylogenetic types and the disappearance of the older ones can be related to changes in the geological past. This apparently means that along with O. SCHINDEWOLF's typogenesis of an endogenous nature, there also operates a complex of evolutionary factors which are of exogenous character.

Accordingly, it has proved possible to refer all the life phenomena, which could be reconstructed, to the dynamic classes set up by the present writer in 1936 in his "System of Life Phenomena", and to point to causal connections following from the classification. It has been likewise feasible to establish the laws which govern the formal, constitutional, and functional behaviour of the persistent, elastic, and progressive-regressive species.

COMPLEX ANALYSIS OF LATE PLEISTOCENE CAVE SEDIMENTS

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A completely new method to analyse deposits accumulated in caves has been introduced in Hungary in the course of the last years. Formerly, scientists contented themselves with the generic determination of bones and charcoals brought to the surface from the sediments, and attention was primarily focused on the bones of larger animals. Pleistocene stratigraphy was mostly based on a comparison of faunal and floral material, while the new method, i. e. complex analysis, has yielded new results in three respects : 1. a more intensive analysis of the remains of smaller vertebrata ; 2. a statistical analysis of the charcoal found in the hearths of primitive man (wherever analysis of this kind is possible) ; 3. a sediment-petrographic analysis of cave-clays.

An exhaustive study of the smaller vertebrata has thrown a new light on slighter pleistocene climatic changes (fluctuation of the numerical ratio of species per stratum), and also on the chronological changes in the variational distribution of the species (variation-statistical analyses). The determination of the — in some cases very rich — charcoal material reveals the interesting fact that flora is much more sensitive to climatic changes than fauna. The picture thus obtained is well-completed by sediment-petrographic analyses which afford an insight into physical environment, in the first place into the changes of air-movements and precipitation

ANTHROPOLOGICAL PROBLEMS IN CONNECTION WITH THE POPULATION OF PANNONIA UNDER THE ROMAN EMPIRE

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One of the principal objects of our recent archaeological and historico-anthropologica researches has been the study of ethnic conditions in the Roman province of Pannonia. A complex analysis of the problem has shown the way in which ethnic processes and consecutive stratifications may presumably be approached from an anthropological point of view. Historically, the population of Pannonia was enriched by settlements from three different directions. Historical-anthropological research work has the task to determine, by means of comparative analyses, the local or native Illyrian-Celtic elements and the immigrant military and civilian constituents of the population, and — after having ascertained pertinent differences — to elucidate their anthropological relationships.

Researches made so far have revealed the following in respect of Pannonia's three centres : Nordic and Protoeuropid elements play the most important part in the North of Pannonia, along the limes, while — in accordance with the ethnic many-sidedness of the various military camps along the eastern boundary — such brachycranial types can be demonstrated side by side with the said typological elements as point to a transliminal origin ; as regards the inner regions of Pannonia, dolichomorphic elements, pointing to southern connections, have been revealed, especially south of the lake Balaton.

THE PHYSICAL DEVELOPMENT OF SCHOOL-CHILDREN

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It is well-known that environmental factors, social and hygienic conditions in particular, exercize a considerable influence upon the physical development of the youth. The periodoc fluctuations of bodily development during the age of growth are therefore of great significance, and the standards of development have to be revised from time to time.

In Hungary, it is only in respect of the school-children of Budapest that we possess an adequate number of recent anthropometric data, while data from the country are sporadic ; because of the said periodic fluctuations, the results of former mensurations cannot be applied to the school-children of our days. It is for this reason that a co-operative group formed from the members of the staff of the Anthropological Institute in the Debrecen University has been performing serial anthropometric examinations on school-children for a number of years. The said group has been divided into smaller research units, and each of these units has examined all school-children of some particular village or villages in order to obtain representative data. The members of each unit check each other's result so as to reduce mistakes resulting from individual errors and methodological discrepancies to the possible minimum.

The geographical distribution of the anthropometric examinations made in primary schools was the following. County Hajdú : in 14 schools (in one town and 10 villages) a total of 2925 boys and 2658 girls ; at Bánvölgy, County Borsod : in 8 villages a total of 636 boys and 530 girls ; County Bihar : in 5 villages a total of 568 boys and 656 girls ; County Szabolcs : in 4 villages a total of 750 boys and 910 girls ; County Szatmár : in 2 villages a total of 292 boys and 354 girls, so that, together, anthropometric data in respect of 5171 boys and 5108 girls, i.e. a grand total of 10 279 measurements have been made available for scientific elaboration. The author gives an account of the evaluation of the said data regarding body-height, body-weight and circumference of chest. Too, he reports on the result of repeated examinations that are being made in the community of Hajdúsámson with a view to controlling the said comprehensive data by recording the annual growth of the school-children.

The mean values of the heights, body-weights and thoracic circumferences of the children examined by the Debrecen staff are compared with similar previous Hungarian data and with recent standard data from the capital ; moreover, the author makes comparisons between the respective data obtained from various regions. The paper comes to the general conclusion that, as regards the above-mentioned three principal characteristics of growth, a certain acceleration of the rate of growth is manifest also in our country.

REPORT ON THE BIOLOGICAL RESEARCH-WORK CARRIED ON IN THE DEPARTMENT FOR ELECTRON MICROSCOPY OF THE INSTITUTE OF MEASUREMENT AND INSTRUMENTATION, HUNGARIAN ACADEMY OF SCIENCES

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Althought but a few decades have elapsed since the discovery of the electron microscope, its use in biological analyses has helped science to take a long step towards a better understanding of the interrelations between structure and function. It seems as if a further development in the use of the electron microscope would give us insight into as yet inconceivable depths. A very many-sided scientific work, covering a wide range of investigations into biological pro-

blems, is now in progress in the Electron Microscopic Laboratory of the above institute. Substances composed of large molecules, viruses, bacteria, and the morphology of cells and tissues form the subjects of these investigations performed in close collaboration with other scientific institutions throughout Hungary. The present lecture refers to questions of methodology, a central problem of the Laboratory. Investigations into problems of methodology, now in progress, are of three kinds.

1. Elaboration of appropriate methods for the preparation of objects belonging to different size categories with due regard being paid to the requirement that the act of preparation should leave structures intact, that is in a condition similar to their physiological state. The present report gives an account of the elaboration and applicability of the method of pulverization developed for the preparation of objects that can be examined in a direct manner. It also describes the methods of preparing coherent tissues and such objects as are incapable of being transilluminated by means of the electron microscope. The report further includes a description of various methods of disintegration for the analysis of coherent tissues, as also the different ways of purifying disintegrated substances. The importance that attaches to the conditions under which disintegration occurs was particularly emphasized. The author described a method which serves the purposes of cell-analysis and has been elaborated by them for the cultivation of tissues on the electron-microscopic supporting membrane. This was followed by the presentation of a comprehensive picture of the replica-technique and the section-technique as used by the authors.

2. Another group of methodological problems refers to substance-localization. This part of the report deals with a process of micro-incineration as elaborated by the authors for the demonstration of inorganic components ; it also includes a description of the methods by means of which specific enzymatic and chemical dissolving can be effected : the advantages of dialysis were particularly pointed out. There followed an account of the results obtained by the use of specific stains which included a description of the method elaborated for the demonstration of specific proteins and polysaccharides.

3. A third group of the said problems refers to the evaluation of pictures and chiefly to such mistakes in the course of making preparations as give rise to artifacts, further to the ascertainment and elimination of changes occurring in the electron microscope. In this connection, the authors made a study of the action exercized by extreme salt concentrations that are produced in the process of preparation ; further, they studied the effects which the various fixing-methods exercize on structure ; they also examined the changes caused by shadowing, and the formation of artifacts elicited by the action of electron-rays.

ELECTRON MICROSCOPICAL INVESTIGATIONS ON THE SMOOTH MUSCLE

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Biochemistry and submicroscopic morphology, the two adjoining branches of science, supply but scanty data concerning the smooth muscle, which plays a significant part in building up the structure of the organs and organic systems of animals in the lower and higher evolutionary stages, and is equally important in its bearings on functions. The object of the present experiments was to study the finer structure of the non-striated muscle and the chemical conditions associated with it. The material studied consisted of human and bovine myometria, gizzards of pigeons and geese, and from among the mollusks, the feet and closing muscles of *Anodonta complanata* and the feet muscles of *Helix pomatia*. For electron miscroscopic inspection this material was prepared in two ways : (i) by microdissection of the tissues, applying micromanipulation, and (ii) by isolation and chemical treatment of the fibrillae. The principal difficulty presented itself in the differentiation under the electron microscope of the fibrillary structure into elements of smooth muscle and connective tissue. This difficulty was overcome by the electron microscopic inspection of smooth-muscle cells, which permits the study of the finer cytoplasmic structure without any violation of the intercellular topography. It appears safe to state that the cytoplasm of smooth-muscle cells consists of protofibrillae taking parallel courses. In smooth-muscle cells isolated from the bovine uterus these protofibrillae are 710 $\pm$ 100 Å in diameter. In the distal parts of cells the protofibrillae are seen to anastomose. Following the

electron microscopic study of the intercellular structure we disintegrated our material in saline using WARING's blendor or dissecting needles. In the suspension so obtained, it was easier to decide which elementary fibrillae were identical with the intercellular structures of cells isolated by micromanipulation. On comparing the smooth-muscle cells of animals in various philogenetic stages, it has been found that whether fixed in formol or prepared from native material, the smooth-muscles are built up from submicroscopic elementary fibrillae (protofibrillae). In the feet and closing muscles of *A. complanata* and the feet muscles of *H. pomatia* the fibrillae are 915 $\pm$ 100 Å in diameter. The average diameter of the fibrillae in vertebrates is 715 $\pm$ 100Å. The finer structure of the smooth-muscle was also followed up with electron microscopic histochemical methods. The morphological picture was found to have changed after the treatments. On releasing myosin of 0,5 ionic strength and pH 6,5, with the method of HASSELBACH and SCHNEIDER, it was found that the subfibrillae had loosened and removed from one another, indicating that the myosin had built itself in between the subfibrillae. On applying WEBER and EDSALL's treatment at pH 10 a certain degree of destruction was observed to take place in the subfibrillae. These conditions of release were found to be equally valid for myofibrillae isolated from the human or the bovine uterus. Myofibrillae of mollusks dissolved more readily upon treatment. Subfibrillae subjected to after-treatment with KSCN solution of 0,15 ionic strength became disintegrated. No structural change whatsoever took place in the collagen, which is invariably present in the preparations. Besides the connective-tissue fibers running a straight course, a peculiar helical structure of these fibers was encountered in preparations of smooth-muscle tissue from vertebrates as well as snails. The same subfibrillary build having been encountered in both the mollusks and vertebrates, it is believed that a subfibrillary structure is characteristic of smooth-muscle in general.

THE PROBLEM OF PREEXISTENT STIMULUS-CONDUCTING PATHS IN CILIATA

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In contradistinction to the intraplasmatic fibrillar system of the neuromotor apparatus and the pellicular fibrils of KLEIN's indirectly connecting silver-line system, it is the kinetodesmal fibrils, extending underneath the pellicula and joining the basal bodies of the cilia together, which have not ceased to be regarded by some authors as conductors of stimuli. Indeed, their morphological continuity and close contact with the basal bodies of the cilia seem in most cases to furnish an appropriate explanation for the coordinated ciliary motions or the versatile motility of the locomotor apparatus which latter is composed of uniform elements. Yet, we still need a convincing biological experiment that would actually demonstrate the conduction of stimuli along these paths and thus supersede all indirect explanations and inferences.

Methods of investigation, elaborated in the last years, make it possible to throw light on the mechanism of ciliary activity, a problem that has been the subject of controversies for a number of decades. Experimenting with preparations made by means of quick fixing as also with narcotized living animals, the author has succeeded in accurately determining the direction in which, first of all during normal locomotion, metachronic waves flit along the *Paramecium*. It was found that these waves do not travel parallel to the interciliary fibrils but are usually propagated along the cell-surface in a right-forward direction. The fact that the spread of the metachronic waves is independent of the interciliary fibrils is still more conspicuous when stimuli are applied. For instance, in stationarily rotating animals the direction of the longitudinally running waves that travel round the cell surface is perpendicular to the interciliary fibrils, while the said waves form concentric rings around the point of excitation in locally stimulated individuals. If we compare the different varieties of the metachronically arranged ciliary motion in the *Paramecium* with the course of the interciliary fibrils in the different parts of its body we are forced to the conclusion that the said system of fibrils can have no part in the constant co-ordination of the ciliary beats. In reality, metachronic impulses do not travel along isolated and predetermined paths but are propagated all over the cell surface and in all directions with nearly equal ease. The close contact of the executive organelles on the cell surface with the interciliary fibrils can be satisfactorily explained even if nothing but their morphogenesis is taken into account.

THE FORMATION AND SOME PHYSIOLOGICAL CHARACTERISTICS OF THE TWINS OF KAHLIA

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The appearance of twins fused back to back was observed in cultures of *Kahlia simplex* grown in gelatin-earth-solution and inoculated with *Agrobacterium tumefaciens*. The twin forms were identical with those induced by UV-light.

Present experiments have confirmed earlier observations that the twin forms arise from animals having large, round contractile vacuole.

The stability of the twin forms was found to depend to a great extent on the division frequency and to be negatively correlated to the age of the culture.

While the locomotion of the single animals is characterized by a rotation along its long axis in the manner of a spiral, the twins rotate forward along a straight line.

The nutrition of twin forms appears to be quite similar to that of single individuals.

The fission of twins and single individuals is identical. The rate of division of the twins is greatly influenced by temperature and generally half as high as that of singles.

The activity of the contractile vacuole is generally alike in both partners of a twin individual provided they are in a complete junction, while in individuals incompletely connected it may be entirely synchronous or asynchronous and of the same frequency.

EXPERIMENTS OF SUBSTITUTING THE WHITE OF HEN'S EGGS

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During the years 1949—1956, several hundred experiments have been carried out to substitute the white of hen's eggs, using Leghorn and Rhode Island varieties as recipients, and Leghorn, Rhode Island, Hampshire, Welsum, and Yellow Hungarian varieties, also guinea hens and turkeys, as donors. The individuals brought forth, and their offspring, were observed to display an acceleration in the rate of development, a difference in the formation of the secondary sexual characteristics and in colour. The effect of the quantity of white substituted, the exchangeability between varieties and, keeping the germinal disc under observation, the mechanical effect of the substitution, were likewise studied. The quantity of white substituted varied from 1 to 12 ccm. Eggs whith the whole of their white substituted failed to produce live chicks, embryonic development in them (3 to 8 per cent) lasting for 7 days at the utmost. All the eggs were examined for the degree of embryonic development in them. It vas found that 7,6% of them failed to develop at all. 26,3% perished between the lst and 3rd, another 20,3% between the 4th and 7th, 14,8% between the 8th and 14th, and 14% between the 15th and 21st day, while 16,2% were hatched normally. Quite a number of choked chicks and malformed embryos was encountered. Choking was mostly due to unfavourable posture of the chicks. The rates of hatchings in dependence on the quantity of white substituted, were as follows: 5,9% on the substitution of 1 to 2,5 ccm, 13,9% if 3 to 3,5 ccm, 11,8% if 4 to 5 ccm, 20% if 5 to 6 ccm, and 28,8% if 8 to 10 ccm of white was substituted. As has been mentioned above, substitution of the whole of the white resulted in no hatchings at all.

From these experiments author concludes that while, due to the interference, the feeble, less viable, individuals perish in the various embryonic developmental stages, the hatched individuals surpass the controls in respect of feed utilization and vigour of growth. In evaluating the changes present in the hatched chicks when raised, the effects of the mechanical interference, and the differences between individuals, must be taken into account. It is not unlikely that the white substituted for the original is biochemically different, but in this respect no data are as yet available. The changes, which in the hatched chicks and their offspring are observed to be the result of interspecific substitution of egg whites, cannot be regarded as a confirmation of a vegetative hybrid character. To draw any conclusions in this particular direction, requires further physiological, biochemical, cytological, and histological enquiries.

Abstracts of papers read at the sessions of the section for botany, plant physiology, genetics and agrobiology

A QUANTITATIVE XYLOTOMICAL ANALYSIS OF POPULUS-SPECIES IN HUNGARY

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The 10-year plan of timber-analysis drawn up by the Hungarian Academy of Sciences has the object to disclose the technical, anatomical, chemical and physical properties of the more important Hungarian forest trees, as also to examine any changes occurring in these properties. The two above-named institutes have undertaken to study the wood anatomy in the trees referred to them.

The first group of trees to be dealt with in the course of the said 10-year plan comprises the more important species of poplars indigenous to Hungary. In their investigations, the authors availed themselves of the usual methods of quantitative microscopy, applying among others the six-spindled integrating adapter and the photometric process. Of the test material collected from four different places 16 samples of 20 to 40-year old trunks have been analysed up to date. The present results of the work in progress are outlined in the following. An initial increase in the width of the growth rings is usually followed by a somewhat fluctuating decrease towards the bark. Although this change is not directly dependent on the annual amount of precipitation, great minima of precipitation have nevertheless their corresponding minima of growth rings. The growth rings of three *P. tremula*-trunks from Marcali make this phenomenon very conspicuous for the period 1935—1946. The number of vessels gradually decreases in all trunks towards the outside ; the *P. alba*, *P. nigra* and some specimens of the *P. tremula* have from 10 to 15% more vessels per growth ring in the late wood than in the early wood, while — — referred to the whole trunk — in the *P. canadensis* we find an approximately even distribution of vessels over early and late wood, so that, in this respect, the wood of this tree is more homogeneous than that of the others. In the *P. canadensis* and the *P. tremula* there are more twin-pores, pore-rays and pore-groups in the late wood, and more solitary vessels in the early wood. The size of the vessels shows a steady growth towards the bark. Heterogeneity-indexes in respect of the radial and tangential diameters of vessels show the *P. tremula* to have the most homogeneous wood among those examined. Tracheal water-conducting area (volumetric ratio of vessels) increases in all trunks towards the outside. It is highest in the *P. canadensis* where it grows from 20% to 45%, and lowest in the *P. tremula*. The respective curves in the diagrams of the late and early wood show often opposite courses. Viewed from this angle, growth rings appear to be most homogeneous when the curve of the early wood reaches a minimum and that of the late wood a maximum. As regards tracheal porosity, it is coarsest in the *P. canadensis* grown at Ásványráró, and finest in the *P. alba* from Bugac. The amount of fibres was found to be highest in the *P. tremula* from Marcali, and lowest in the *P. canadensis* brought from Ásványráró. Fibres decrease in all trunks towards the bark. Going from within outwards, the initial fibre length of 500 to 600μ grows to 1200 to 1400 μ, i.e. increases threefold, during the first 15 years : this is the final length which may increase or fluctuate slightly in subsequent years. The suggestion to satisfy the constantly growing raw-material requirements of the paper industry by utilizing densely planted 10 to 15-year old poplar-stands cannot, therefore, be justified by

considerations of wood anatomy. The value of the volume of medullary rays is around 10% in all trunks, without any perceptible changes towards the bark. To sum up : the results obtained so far are sufficient to make it clear that, in poplars, it is not only taxonomical but also ontogenetic and ecologic factors that exercise a notable influence upon the quantitative and qualitative properties of tissue structure, a fact that merits the attention of theoreticians and practicians alike.

EXPERIMENTS TO OBSERVE MORPHOLOGICAL ALTERATIONS IN PAPAVER SPECIES GROWING WILD IN HUNGARY

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Based on earlier observations of two *Papaver somniferum* varieties, author designed an experimental series in the years 1954 and 1955 involving four *Papaver* species growing wild in Hungary which differ from one another primarily in the number of lobes of the stigma and the shape of the capsule ; they were : *P. argemone* L. var. *glabratum* (COSS. et GERM.) ROUY et FOUC., *P. hybridum* L. var. *microcephalum* A. NYÁR., *P. dubium* L. var. *subbipinnatifidum* (O. KTZE) FEDDE, and *P. rhoeas* L. ssp. *oblongatum* (BOISS.) A. NYÁR. The aim was to study the modifications which on the effect of artificially changed environmental factors would be produced in the vegetative and generative organs, first of all in the shape of the capsula and the number of loculi in the pod. In order to study these modifications, experimental plants were grown in there series : under conditions of irrigation (abundantly watered from sowing to ripening), under dry conditions (sown in pots, then sinking them down into the field, with a minimum of irrigation), and in a control series. A yellow sandy soil from the Nyírség was used which had been manured the year before. From the beginning of the sowing the observations extended to date of sowing, development of the vegetative organs measured at fixed intervals, phenological phenomena, changes in the shape of the pod and in the number of carpels, finally to systematical measurements of the microclimate.

The results of the experiments lasting for two years can be summed up as follows : 1. The sprouting time of all species became shorter as a result of irrigation. In dry cultures the sprouting time was generally 30 to 39 days, while in irrigated cultures 21 to 26 days. 2. The development of the vegetative organs, e. g. the length of the stem, the width and length of the leaves showed higher values in irrigated cultures. For instance, the height of stem, in the case of *Papaver rhoeas*, in dry cultures varied between 5,2 to 22,0 cm, in irrigated cultures between 18,0 to 68,0 cm. 3. As regards phenological phenomena, flowering set in earlier in plants grown in dry culture than in the irrigated one. *Papaver dubium* began to flower in the irrigated plot after 52 to 55, in dry culture 40 to 41, in control plants 43 to 49 days. 4. In the number of loculi of the pods, too, there occurred an essential change. Similarly to the observations made on *Papaver somniferum* in 1953, it was found that owing to irrigation the number of loculi in the pods had increased in all four poppy series as early as in the first year. For instance, in *Papaver argemone*, instead of the original 4—5 stigma-lobes, 6—7—5 lobes or capsular loculi were predominant in irrigated plots, and 4—5—3 in dry cultures ; in *P. rhoeas*, instead of the original 10 stigma-lobes, 11—12—13 had developed as a result of irrigation and 6—7—8—9 in dry cultures. In the case of all four species intermediate mean values have been obtained in the control plots. 5. KELLER's index was applied in determining the shape of the capsules. Capsular shape was found to be a more constant characteristic than the number of capsular loculi, for during the two years only minor alterations in shape could be observed, which in *Papaver argemone*, for instance, were towards the elongated ovoid form, in dry culture. On the other hand, an increase in the number of carpels showed a certain measure of correlation with the tendency to develop round and wide ovoid capsules.

Summing up what has been said, it can be stated that the morphological properties of the *Papaver* species growing wild in Hungary depend to a great extent upon the environmental factors ; the change in the number of loculi in the capsule is particulary characteristic ; this number fluctuates according to the possibilities of the water supply and intake of nutriment, it is therefore not a constant character and, consequently, cannot be taken into consideration in the separation of certain species. It would be advisable to omit the relevant numerical data from the keys. Likewise, the descriptions of capsular shape are not precise either, and it would be more expedient to use KELLER's index values, on the analogy of cultivated poppies.

REVIEW OF PLANT ASSOCIATIONS IN HUNGARIAN SANDY SOILS AND THEIR PHYLOGENY

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In order to place new practical methods at the disposal of modern socialist agriculture and forestry, Hungarian geobotanists extensively study the interactions of vegetation and environment in an endeavour to bring about a synthesis of the different ecologic, floristic, coenologic, and genetic trends. One of the widest fields in which to carry out synecologic studies (including analyses of soils and microclimates, experiments concerned with the phenomena of adaptation), coenological and applied phytogeographical investigations, is the vegetation in sandy soils.

The open grasslands on sandy soils constitute the group *Festucion vaginatae* Soó (1929). Within the *Corynephoretea*, this group, as a continental South-east-East-European series of basophil-acidoclinal character, is separated in the present paper from the West- and North-European acidophil-basiclinal *Corynephoretalia*, and given the name *Festucetalia vaginatae* Soó. The *Festucion vaginatae* group itself can be divided into two subgroups: 1. *Bromion tectorum* Soó consisting of the pioneer grassland associations of annual plants, is *Brometum tectorum* "principal association", and has the common dominant species and similar synecologic conditions as the group *Tribulo-Eragrostion* Soó et Timár. 2. *Festucion vaginatae* Soó s. str. are the sand-binding grassland associations with two principal associations: the basophil *Festucetum vaginatae* and the acidoclinal *Festuceto-Corynephoretum*. I consider the geographical variants of all of them as associations s. str.

On synecologic as well as floristic and genetic evidence, the closed grasslands on sand, as "plakor" steppes, together with the similar associations of sloping steppes, should be referred to the *Festucion sulcatae* Soó (1929) 1940 group (*F. valesiacae* Klika 1929—1931 pro parte), which belongs to the *Festucetalia* (*valesiacae-sulcata*) Soó 1940, Br. Bl. et Tx. 1943 series, i. e. the large eastern-continental series of the *Festuco-Brometea* class of dry grassland. Such two principal associations in the group are *Astragalo-Festucetum sulcatae* of the natural meadows on sand, and *Potentillo-Festucetum pseudovinae* of the dry pastures on sand. *Chrysopogonetum*, the meadow of tall grass on sand, can only be regarded as a consociation of the former, similarly as stands of the rare *Festuca stricta* var. *hungarica*. In most of the associations, however, subassociations and facies can be distinguished on the basis of ecological differences (primarily in water supply) and conditions differing in respect of dominancy and quality (differential species). Being soil indicators, these subassociations and facies are of conclusive importance in forming a judgement of the possibilities and methods of the sand afforestation.

The pine-birch forests and cold steppes of the early postglacial period (IV) were, in the xerothermic hazel-period (V), succeeded in the sand areas of the Hungarian Plain by *Festuca-Stipa* steppe meadows of assumedly tall rasses with shrubs, in elevated spots of higher groundwater level, with oak or ash groves. (Cf. the present disposition of vegetation zones in Siberia, where taiga contacts grassy steppe; Aliochin, Soczawa). Later in the more humid period of mixed oak forests, the forest steppe began to take shape and first *Querceto-Festucetum*, thereafter *Querceto-Convallarietum* became dominant. Like in the Hungarian Middle Mountains chiefly *Querceto-Cotinetum*, so is in the Great Hungarian Plain today *Querceto-Festucetum* the representative of the forest steppe. In the cooler and more humid beech period the Hungarian Plain, with the exception of the loessic elevations on it, was covered with swamps, bogs, and hornbeam-oak forests (*Querceto robori-Carpinetum hungaricum* Soó nom. nov.). The relict plant species of montane character from the beech-period inhabit today *Querceto-Carpinetum*, *Querceto-Convallarietum* and, for their greatest part, *Querceto-Ulmetum hungaricum* Soó 1955. Accordingly, *Querceto-Festucetum* and the forest-steppe species are remnants from the postglacial warm-period, the Atlantic (VI-VII mixed oak forests), while *Querceto-Carpinetum* and the elements from mountain forests have survived from the sub-boreal-subatlantic period (VIII-IX, beech I—II).

In historic times, with the disappearance of forests, quicksand turf and deteriorated *Junipereto-Populetum* shrubs have developed, and marshlands (*Agrosteto-Molinietum* (Magyar) Soó nom. nov.) have arisen in the hollows between sand hills rendered swampy by ground water rising in consequence of deforestation.

Of late, Wendelberer claims that the climax of the middle warm-period was the forest-steppe and not the grassland steppe. The present author maintained the same view, having determined the grassland steppe as the type of vegetation dominant in the early (boreal) warm-period (Soó). According to Wendelberg, however, it was the mixed oak forest that immediately succeeded the pine-birch forest steppe. He raises again the idea of "Erhaltungszentren"; the

present author has pointed out on several occasions that is was the loessic elevations and the sand spots of the forest steppes that constituted that reservoir which ensured the continued existence of the primary steppe flora and its spread, in historic times, over the secondary culture steppes. The "Waldsteppenkomplexe" being in the hills of Pannonian character in Lower Austria on the borders of plains, is divided by WENDELBERGER into three parts : the *Quercus pubescens* forests, the *Prunus fruticosa-nana (tenella)* shrubs, and the limitrophe association described under the name *Dictamno-Geranietum*. In the classical habitats of *Querceto-Festucetum* (in the southern parts of the Nyírség), on the borders of common-oak timber forests, as contact-zones, hawthorn-oak shrubs are frequently encountered, as a transition towards the clearings of *Astragalo-Festucetum sulcatae*. The species which the rocky grasslands and sloping grasslands have in common with the grasslands and meadows on sand, give the coenological proofs of the "Ősmátra" theory.

PRELIMINARIES TO A MONOGRAPH OF THE KARSTIC HAIRY-OAK BUSH FORESTS IN HUNGARY

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About 12 per cent of the territory of Hungary is covered with forests. A considerable proportion of the forest areas, particularly within some parts of the Hungarian Middle Mountains, is occupied by bush forests or is treeless (e. g., about two thirds of the Keszthely Mountains, half of the southern Vértes Mountains). The fact that such large areas are practically useless or their profitable employed for forest culture is very difficult, fully justifies an early and extensive study of the country's bush forests from the point of view of their biocoenology, ecology, formation, spread, and economic aspects. Complex efforts are being devoted in our Institute to work these bush forests as biogeocoenoses. The present paper deals only with a few points selected from a monograph in preparation. So far the Hungarian bush forests have been analysed in their coenologic, physiognomic, areal-geographic, and pedologic relations. Coenologically, they comprise two associations. One is *Querceto-Cotinetum* occurring on the southern slopes and and dominated by the following characteristic species, viz. : *Carpinus orientalis*, *Carex halleriana Coronilla coronata*, *C. emerus*, *Mercurialis ovata*, and *Crepis nicaeensis*. The other is *Quercus pubescens-Prunus mahaleb* ass. (nomen nudum), which occurs in the north- eastern half of the Hungarian Middle Mountains, primarily on limestone parent rock, mostly as a broad margin of a timber forest facing open grassland, and characterized as a rule by dominant species of only restricted local significance, namely : *Prunus mahaleb*, *Asyneuma canescens*, *Carex michelii*, *Veronica spicata*, *Peucedanum cervaria*, *Geranium sanguineum*, and *Polygonatum odoratum*. *Querceto-Cotinetum* is a Balcanic eastern submediterranean association, which together with its characteristic species links up with the *Orneto-Ostryon* group, while *Quercus pubescens-Prunus mahaleb* is an association which joins the *Dictamno-Sorbion (Quercion-pubescentis-sessiliflorae* group of a more eastern and more continental character. The physiognomic appearance of *Querceto-Cotinetum* is conspicuous for the absence from it of a sharp separation of the species characterizing rocky grassland, steppe meadows, or forest land, and for the practically homogeneous undergrowth in the patches of bush forest, which as a rule are mosaically interspersed with shrubs *(Cotinus)*. *Quercus pubescens-Prunus mahaleb* associations, on the other hand, combines not with shrubs but with steppe meadow to form mosaics, and the xerotherm elements never penetrate the inner portions of the patches of bush forest. The plants in the two associations of the karstic hairy-oak bush forests of Hungary markedly differ areal-geographically as well. The submediterranean character of *Querceto-Cotinetum* is barely perceptible in the *Quercus pubescens-Prunus mahaleb* association. On the other hand, the Eurasian and European areal types, consisting chiefly of continental-grassland, forest-steppe, and forest species, are more numerous in the latter. Dealing in detail with the evolution of these karstic bush forests in Hungary, the writers believe them to have been most widely spread in the Atlantic period ; some of the karstic bush forest and rocky grassland species they regard as relicts uninterruptedly present since the last interglacial epoch. The soils of these hairy-oak bush forests agree in that they have only a shallow fertile top layer and accumulate much organic matter. Due to the adsorption of much calcium, their pH is neutral or slightly alkaline. On the whole, they can be included in the same large type, but within this there are four subtypes to be distinguished, differing from one another considerably in origin and properties, namely : limestone rendzinas, dolomite rendzinas, erubase, and relictum terrarossa soils.

GEOBOTANICAL MAP OF THE "TISZAZUG"

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Assisted by my collaborators I was able to finish, in the course of the years 1954—55, the coloured vegetation map which, made on a 1 : 10 000-scale, shows the third region of the Great Hungarian Plain, the so-called Tiszazug, a geographically sharply circumscribed area beyond the Tisza (i.e. the corner formed by the rivers Tisza and Körös) ; the map is now to be presented.

In drawing the boundary lines of vegetation I have strictly followed the principle — emphasized also in the discussions arranged by the Academy in 1954 — according to which all associations are in the first place functions or indicators of the soil. This principle, accepted also by western scientists at about the same time, has a special significance in recognizing and separating associations of wide arable lands. It is coenologically quite as wrong to judge crops on the strength of the sown culture plants as to make distinctions on the basis of the dominant plant forms, since — as regards the composition of weed — there is a greater difference between wheats grown in different types of soil than that between wheat, barley, oats, rye, and other cereals grown in identically composed soils. Ubiquitous—cosmopolitan plants do by no means reveal those differences which are often displayed by character-species.

The colours of the map, adequately compared, disclose all possible vegetations of any particular area, and it is therefore superior in this respect to mere soil or geological maps.

THE PHYSIOLOGICAL ROLE OF CAROTENOIDS IN CHLOROPHYLLOUS ORGANS

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Irrespective of the plant species, the following carotenoids are invariably present in green leaves : α-and β-carotene, β-carotene-mono-epoxide, traces of α-and β-cryptoxanthin, xanthophyll (lutein), antheraxanthin (zeaxanthin-mono-epoxide), violaxanthin (zeaxanthin-di-epoxide) and the cis-isomers of some of these compounds. Again irrespectively of the variety, cholorophyllaceous fruits (the unripe fruits of various paprika and tomato varieties) contain the same pigments as the green leaves, but only in amounts from one twentieth to one thirtieth, and α-carotene is either altogether absent, which is the more frequent case, or is present merely in traces.

The presented data permit the conclusion that the carotenoids act as oxygen transmitters during photosynthesis and are transformed in the course of this funcion. The primary pigments of β-structure (β-carotene, zeaxanthin, β-cryptoxanthin) take up oxygen and are thereby transformed into their epoxides (β-carotene-mono-epoxide, zeaxanthin-mono-epoxide, β-cryptoxanthin-mono-epoxide). After delivering the oxygen the epoxides are either re-transformed into the original compounds, or the α-izomers (α-carotene, xanthophyll, α-cryptoxanthin) are formed. It had been assumed that a single carotenoid is involved in photosynthesis of chlorophyllaceous organs (WARBURG, CALVIN, STANIER) ; this is evidently not the case, all carotenoids represent a step in physiological function.

The main line of oxygen transport runs the course zeaxanthin → antheraxanthin → xanthophyll, while the β-carotene → β-carotene-mono-epoxide → α-carotene and the β-cryptoxanthin → β-cryptoxanthin-mono-epoxide → α-cryptoxanthin lines are held in reserve, to operate in case the main line is overloaded and unable to carry all the required oxygen. This assumption explaines why zeaxanthin is absent and antheraxanthin present only in traces in green leaves, which contain at the same time much xanthophyll. That reserve systems operate is proved by the presence of α-carotene and α-cryptoxanthin which are accompanied by much β-carotene and traces of β-cryptoxanthin and β-carotene-mono-epoxide. Since in unripe fruits there is less oxygen to transport, one of the reserve systems (β-carotene → β-carotene-mono-epoxide → α-carotene) is out of action and therefore no α-carotene is formed.

ON THE INHERITANCE OF THE FOUR-ROWED CHARACTER OF EARS IN MAIZE

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A maize plant from variety "Florentine" of commercial origin had four-rowed top ear and six-rowed lower ear, and its open-pollinated offspring gave rise to four-rowed lines after inbreeding. The I_4 lines were crossed with seven different strains showing eight, about ten ($10{,}21 \pm \pm 1{,}72$; $10{,}75 \pm 1{,}19$; $10{,}92 \pm 1{,}18$; $11{,}42 \pm 1{,}34$), twenty ($20{,}91 \pm 2{,}59$), or about thirty-five ($35{,}81 \pm 6{,}42$, Jap Hulles) rowed ears.

The averages were always higher in the F_1 than the mean value of the two parents, but there was no complete dominance, and the deviation from the mean increased inversely with the increase of the kernel-row number of the strains. Ears with $^4/_8$ rows were observed frequently by TAVČAR in the F_1 of four by eight rowed crosses, however, it reccurred in our material only once among the F_1 hybrids. The changes in dominance reported by BURDICK in glass-hous experiments were similarly not observed in our field tests. Nor were our segregation ratios in accordance with the dates of TAVČAR and BURDICK, and therefore it is assumed that our four-rowed lines were not equal to theirs.

The inheritance of the four-rowed type of our lines was somewhat complicated. The variance in crosses between the parents with lower kernel-row numbers was surprisingly high and not far from that of the F_2 progeny. However, one of the strains with ten-rowed ears ($10, 21 \pm 1{,}72$) gave in the crosses with the four-rowed type exclusively eight-rowed offspring (39 ind.). It can be supposed that the high variance observed is perhaps due to the fact that the kernel-row numbers of the corn show a slight tendency to be four or a multiple thereof.

The average of the F_2-s was usually between the mean value of the parents and the average of the F_1, and in most cases coincided well with the values expected (the deviation of $4F_2 - 2F_1 - P_1 - P_2$ from zero was not significant). The deviation increases in the crosses with trains of lower row numbers, and it decreases in the crosses with strains of higher row numbers.

Similarly to the F_2-s, the first back-crosses (F_1 by 4-rowed) gave the results expected (the deviation of $2B - F_1 - P$ from zero was not significant). The only exception was again the cross of the F_1 with the ten-rowed parent mentioned above.

In the F_2 and B_1 progenies of the crosses with low-rowed parents, the percentage of four-rowed ears showed no regularity, whereas the F_2-s of crosses with higher-rowed parents showed that the number of factors controlling the inheritance of the kernel-row number increases grandually with the increase of the kernel-row number of the ear.

INVESTIGATIONS INTO MUTATIONS OBTAINED FROM THE YEAST RHODOTORULA GLUTINIS

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After exposing the yeast *Rhodotorula glutinis* (FRES.) HARRISON to ultraviolet rays, the irradiated suspension was smeared on plates. Variously coloured mutants appeared after an irradiation of 90 and 105 seconds in the small, from 4 to 6-day retarded colonies with a mortality rate of 90%. Using the nomenclature of the British Colour Council: while the original colour was *igneus*, one of the obtained mutants was somewhat darker, i.e. *mandarinus*, and the other ten mutants had brighter colours, i.e. *miniatus*, *aurantiacus*, *aurantiacus-hispanicus*, *cadmio-aurantiacus*, *roseus-orientis*, *salmonicolor*, *ranunculoides*, *citrinus*, *croceus* and *eburneus*. Subjecting every mutant to microbiological examinations, made under identical conditions, their colour was found to be durable. We did not observe microscopically perceptible cytomorphological differences between the mutants; the giant colonies are not sectored but the *mandarinus* and *aurantiacus-hispanicus* mutants utilized the gelatine. Culture media were prepared with all combinations of five nitrogen sources (potassium nitrate, ammonium sulphate, carbamide, asparagine and peptone) and of five carbohydrate sources (glucose, galactose, saccharose, maltose and lactose): there was no difference between the various mutants regarding their behaviour in the respective media. Generally, all mutants seemed to thrive best in media composed of

peptone-saccharose and ammonium sulphate-maltose, respectively ; carbamide was found to be a feeble nitrogen source, while none of the mutants seems to assimilate lactose. Potassium nitrate was utilized by all mutants. Glycerine and ethyl alcohol proved to be good carbon sources. Ferri-ion had no influence upon colouring. RIZKI's chromogenous induction, usually employed for bacteria, failed to produce any effect, none of the colours exercized any effect on any other colour on the colourless mutant.

The analysis of the carotenes of both the original strain and the mutants was also taken in hand. Methods of isolation as recommended in the literature could be used only with considerable modifications. Column-chromatograph served to separate the poliens. A 4 : 1 mixture of $Ca(OH)_2$ and Al_2O_3 was used as adsorbent. So far, six kinds of carotenes have been found in the original *igneus* strain : dissolved in petrolaether, these needed 45 minutes for their most vigorous development. In the case of the *mandarinus*, i.e. that mutant which had a darker colour than the original strain, there were hardly any lemon and orange-coloured or pink components to be seen on the column. On the other hand, of the purplish red polien (that becomes intensively violet in ultraviolet light) which, owing to its strong adsorption, was seen to have adhered to the upper part of the column in the case of both light and dark mutants, there was an abundance in the *mandarinus*. Thus, the light components were absent from this mutant.

A repeated irradiation of the mutants (possessing a lower capacity to synthetize pigments) sometimes could produce a colour scheme only slightly differing from the mutants — generally somewhat brighter. Passed through a liquid, most of these new colours reverted to the colour of the first mutants ; yet, mutants that had completely bleached did not recover their colour even after repeated passages.

CROSSES WITHIN THE TRITICINAE GROUP

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Botanical investigations (KOELREUTER, WILSON, etc.) demonstrated the possibility of producing hybrids by crossing plants of different species and different genera. Crosses of this kind have become indispensable for the solution of problems connected with practical plant improvement. Their use has extended the range of combinative plant breeding, since varieties thus bred reveal characters unparallelled in their group.

Experiments made in this respect have shown the following results.

1. In *Triticum* x *Secale* crossings the highest rate of seed-setting is obtained if *Triticum* is used as ♀. Reciprocal crossings are mostly unsuccessful.

2. The crossability of wheats with rye shows a growing tendency from the diploid to the hexaploid series.

3. It was found that the $4\times$ rye is more susceptible to being crossed with wheat than the $2\times$ rye.

4. It was possible to isolate biotypes of great combining capacity from aestivum females crossed with rye. Well-combining biotypes have further been isolated from male populations of *Agropyrum intermedium* and *elongatum* if crossed with *T. aestivum*, wheat-rye hybrids and *Triticale Martonvásár 1*. It is therefore possible to isolate well-crossable biotypes both from the paternal and maternal side. There is a comparatively high ratio of well-crossable biotypes in pollen mixtures which serves to explain the advantages of pollen-mixture pollinations.

5. The use of readily combining biotypes has the following advantages :

a) lower number of crosses,

b) choice of partner according to economic value.

6. The degree of crossability can be used as a clue to determine conditions of affinity to a limited extent only, since response to crossing between species, and even between variaties of the same species, depends on the composition of the population, i.e. the proportion of readily combining biotypes.

7. Our earlier observations seem to be confirmed by the fact that, with the exception of the timopheevi crosses, KATAYAMA's "*Triticum type*" gives the best results within the genus *Triticum*. The percentage of seed-setting is higher in the direction $4x\times 6x$, while that of germination is invariably higher in the direction $6x\times 4x$. *Timopheevi* crossings will have to be kept under further observation.

8. As the distribution of chromosomes in the parents has a greater influence on the germination of the F_1 generation than on the setting of its seeds, it was convenient to choose that parent for mother which had the higher number of chromosomes. Although seed setting is slightly worse in this case, this drawback can be counter-balanced by the use of readily combining biotypes.

Crossing experiments within the *Triticum*-group are of two kinds. One is introgression, by which some specific characters are transmitted to particular forms, while the other kind of experiments has the object of producing the two species or genera in the form of a new constant intermediate hybrid. By means of introgression the range of both species and genus can be amplified. The sand-tolerance of rye, the beardedness of its stem below the ear, the tillering of *Agropyrum*, its perenniality, the elasticity of its straw, have proved to be properties that could be transmitted to and localized in the genus *Triticum*. Synthetic "species" produced by means of amphiploidization have a great significance for the study of genetic relationships and the methodology of practical plant breeding.

THE LATEST ACHIEVEMENTS OF ELECTRON MICROSCOPY IN PLANT CYTOLOGY AND HISTOLOGY

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The ever widening application of electron microscopy in cytological research work, due predominantly to progress in the technique of preparing objects, is yielding a gradually increasing number of significant data concerning the finer structure of cell components ; in fact, it has given rise to a new branch of science : electron microscopic cytomorphology. Electron microscopic studies of plant cells permit direct recognition of the microfibrils of cellulose cell-walls, of the structural peculiarities of microfibrillary textures ; moreover, in certain instances they have furnished details regarding the mode and mechanism of cell-wall growth. Electron microscopy has largely confirmed the knowledge we have obtained of the submicroscopic structure of the cell-wall by earlier indirect means, such as polarizing microscopy and X-ray diffractography. Of the protoplasmic cell components, the flagella and cilia make objects particularly suitable for electron microscopic inspection. Recent development of the technique of cutting sections with the ultramicrotome has made it possible to study the ground substance of the fixed cytoplasm, other cytoplasmic bodies as boundary layers, mitochondria, microsomes, nuclear spindles and further the nucleus and the chloroplasts. The study of chloroplasts has yielded exceedingly significant and far-reaching results, which furnish direct evidence concerning the lamellar structure of both the stroma and the grana.

The present authors' investigations are concerned specially with the cell-wall structure of the *Chara* species, in which the primary cell-wall has been found to display submicroscopic groups of pores.

THE USE OF TTC IN MEASURING DEHYDROGENASE ACTIVITY IN PLANT MATERIALS

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The experimental conditions have been studied which are capable of ensuring the quantitative character and reproducibility of the authors method when applied to plant materials containing many endogenous substrates. The roots of 3-day old pea seedlings and commercial Baker's yeast were used in the investigation. In accordance with expectations, formazan formation has been found to increase linearly with the amounts of material added, where pieces of tissue were used, but exponentially, where homogenized material was applied. The change of the

reduction during the experiment, too, has been observed to differ in the intact and the homogenized object. The curve of the former is initially linear and later flattened ; that of the latter is likewise linear at the beginning, but begins to rise steeply after incubation for 10 to 15 hours. The flattening is probably due to the endogenous substrate being used up, while the most likely cause of the steep rise is autolysis starting in the homogenized material. Whether the extent of the reduction is illustrated in relation to the incubation time or the amount of material added, the curves of the controls containing only endogenous substrate and those obtained on the addition of substrate run parallel with each other for homogenized material, but are divergent for pieces of tissue. This phenomenon, too, conforms to the expectations on theoretical grounds. If several different substrates are added simultaneously to the material undergoing incubation, the reduction will be found to be about 50 per cent of the total of the reductions obtained with the individual substrates added separately, where the material consists of pieces of tissue, but approaching 100 per cent, where it is homogenized. It is held possible that in normal cells the individual substrates mutually inhibit each the other's penetration, or that of TTC.

Basing themselves on their experimental finding, the authors conclude that in studying plant material containing much endogenous substrate, pieces of tissue are more serviceable for several reasons. First, because the quantity of formazan which during the same incubation period forms in the presence of substrate is directly proportional to the quantity of enzyme. Secondly, because autolysis is insignificant, even after incubation for as much as 20 hours. Thirdly, because the endogenous substrates are relatively soon exhausted and so possible errors due to incompleteness of the addition need not be taken into account. For this reason it is expedient to apply longer periods of incubation lasting for 15 to 20 hours. This is the more justified as incubation times of only a few minutes, usually applied when working with animal tissues, fail to yield measurable results, at any rate for the objects which have been studied by the authors.

Authors have also investigated into the extent to which formation is influenced by the concentration of TTC and the substrate, the route by which TTC finds its way into the tissues and cells respectively, and the ratio of the SH contents of the materials studied to the quantity of reduced TTC. They concluded that as the SH is but a negligible fraction of the formazan, the SH group, contrary to the view of many research workers, cannot be directly responsible for the reduction of TTC.

Based upon their findings, authors have elaborated a method which, owing to its simplicity and swiftness, is very expedient for use in serial examinations, rendering superfluous the preparation of the mitochondria and the previous removal of the endogen substrate.

THE EFFECT OF ORGANIC SULPHUR COMPOUNDS ON THE GROWTH OF PLANT TISSUES

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In tissue culture experiments carried out with *Daucus carota* and *Brassica oleracea* var. *gongloides* it has been established that while methionine, glutathione, cysteine, and thioglycolic acid stimulate growth, cystine and thiouracil exert no such effect. Our biochemical investigations of sulphur compounds made it necessary for us to secure a workable method by which to follow up the biological mechanism in the sulphur compounds under laboratory conditions. To grow tissue cultures seemed to be the most promising method, and *Solanum tuberosum* the most serviceable object. For growing tissue of *Solanum tuberosum* a method was evolved which, contrary to those hitherto applied, contained no growth factor of unknown composition. For this purpose the White—Skoog mineral nutrient medium with the appropriate vitamins, and a 10^{-4} M concentration of 2,4-dichlorophenoxy-acetic acid proved to be most suitable. Tissue growth was controlled by weighing every third day 16 to 25 explants and their dry-matter contents, respectively. Concentrations of 10^{-3}, 10^{-5}, and 10^{-7} M of glutathione were found to be the best to demonstrate the SH effect, while for the blocking experiments a 10^{-3} M concentration of $CdCl_2$ was used, following the animal experiments of Koshtoyants. A $CaCl_2$ solution of the same concentration was employed to exclude the bivalent ion effect and the presence of Cl poisoning. With a view to finding out if the Cd inhibition could be made reversible, the cultures were transferred to other media after 3 days.

Our findings permit the following statements : 1. The potato explants rose in weight from the initial 5,4 mg to 14,3 mg on the 14th day, the dry weight from 1,0 to 1,6 mg. 2. Upon

the action of a 10^{-5} M concentration of glutathione growth was marked, particularly in dry weight (17,5 and 2,1 mg respectively). 3. A 10^{-3} M concentration of $CdCl_2$ brought growth to a standstill (4,5 and 0,8 mg). 4. $CaCl_2$ produced no appreciable inhibition (12,3 and 1,2 mg). 5. The inhibition brought about by $CdCl_2$ could not be released with 10^{-4} M of 2,4—D (6,6 and 0,8 mg). 6. The inhibition induced by $CdCl_2$ proved to be reversible on transfer to a nutrient medium containing 10^{-5} M of glutathione.

SULPHUR IN THE LIFE OF PLANTS

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Experiments have been carried out, first, to follow up during the entire vegetation period the variations in the methionine and SH contents of the bleeding sap in maize, and secondly, to measure for eight consecutive days the same contents of homogenates prepared from 3 mm apical growing points and 5 mm pieces of the root hair zone in bean and maize seedlings.

The SH content of the bleeding sap in maize was found to attain three peak values during the vegetation period in relation to both the absolute and the total sulphur content: the first peak was reached on the 22nd day of the vegetative phase of growth, the second on the 53rd day of growth at flowering, the third on the 97th day of growth when the fruits were ripening. The peak values for the total sulphur content coincided with these dates. The free methionine content of the bleeding sap varied along different lines: it rose gradually until flowering set in, whereafter it dropped first slowly, then rapidly. From among the SH compounds glutathione could be identified.

In the apical growing point of maize seedlings the SH content attained its maximum on the 4th day of sprouting, evenly to drop thereafter; in the root hair zone it did not change between the 2nd and 4th day, but displayed a marked drop from the latter day onwards. In the apex of bean seedlings it suddenly rose after the 4th day, but in the root hair zone it began slowly to drop following the peak on the 4th day. In both plants the 3 mm piece of apical growing point contained nearly twice as much SH as the 5 mm piece from the root hair zone.

During the 8 days of observation the free methionine content in both root portions sunk uninterruptedly in maize, but rose continually in bean seedlings.

Based upon these findings the authors conclude that roots have an essential part to play in the sulphur metabolism of plant and that this metabolism greatly differs in character in leguminous and non-leguminous plants.

THE SIGNIFICANCE OF SUMMER-PLANTED NEW POTATO TUBERS FORCED WITH "RINDITE"

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The best way to parry the "deterioration" of potato crops which in regions with hot summers is caused not by viruses but by ecologic factors is to plant the potatoes in summer, creating temperature conditions favourable to the development of tubers. If it were sufficiently wide-spread, summer planting would produce enough good-quality tubers for seed to cover the country's requirements. One of the reasons why summer planting for seed has not become general is the difficulty of storing the seed. The method to avoid the storage problem is to use for summer planting new tubers from the immediately preceding spring planting. Explorative experiments carried out a year earler furnished evidence that the most suitable agent for the germination of Hungarian potato varieties is "Rindite", which is a 7 to 3 to 1 mixture of ethylene chlorohydrin, ethylene dichloride, and carbon tetrachloride. Applied to the Early Yellow, Early Rose, and Lorch varietis, this mixture yielded satisfactory results in field experiments in 1953. This is an evidence that there is nothing in the way of starting large-scale production. Comparative experi-

ments made in different soils showed that in some varieties (Early Yellow, Rose of Kisvárda) density was quite good, in some others (Early Rose, Lorch) reasonably good, yet in others (Gül Baba, Ella) very poor. The number and quality of shoots was found to affect essentially the number and size of new tubers. A study of the interrelations between number and quality of tubers and number of shoots revealed that 4 to 6 shoots are the most desirable, because they yield the highest number of tubers per plant and more of the smaller-sized tubers which are the most suitable for seed. Nevertheless, tubers treated with "Rindite" not infrequently develop 1 to 3 shoots only, when the new tubers are few (15—12) in numbers but of large size, often weighing as much as 500 g and being useless for "seed" purposes.

In spite of the deficiences mentioned above and bearing in mind the results of the experiments, it appears that several home varieties, if treated with "Rindite", can be used to advantage for the production of a second crop and, concurrently, of good quality tubers for seed. There are, of course, a few indispensable prerequisites of applying the treatment, viz.: sufficient moisture in the soil, appropriate depth of sowing, the right concentration of "Rindite", and the right timing of the treatment. Concentration of the chemical agent and duration of the treatment vary with the different varieties, but in addition depend on the date the young tubers are harvested, and on the time that is allowed to elapse from lifting to the actual application of the chemical. If the aim is to attain 100-per cent germination, 5 or 6 days after the first treatment all the tubers in which the shoots failed to start growing, must be assorted and picked out and must be given an after-treatment involving half the original dose and lasting for the same length of time. After the chemical treatment pregermination of the tubers is not required at all, because they sprout sooner if sown directly in the soil. The chemical agent does not alter the quality of the tubers, nor does it influence their varietal properties; it decomposes the inhibitory substances that accumulate in the peel, increases the quantity of glutathione, and changes the permeability of the plasma, whereupon germination commences. Products of several seasons proved to have advantageous qualities due to the new method, consequently there is no reason for anxiety in applying it.

A NEWLY DETECTED HOMOXYLOUS TREE

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In a collection sent to me for identification by Miss KAEISER, the American xylotomist, which comprised sections of about 20 different kinds of *Podocarpus*, there was one, labelled *Podocarpus nubigenus* (= *Saxegothea gracilis* HORT.), the wood structure of which would in no way fit into the family of the Podocarpaceae and which turned out to be probably a homoxylous tree.

In *cross-section*, the wood appears to be perfectly homogeneous. It only possesses tracheids which, quite analogous to those in conifers, are arranged in radial rows. No growth rings can be observed, or they are barely perceptible. The rays are commonly 1—2—3, occasionally up to 5 or 6 cells wide; their horizontal walls are relatively thick, with numerous simple pits in them. The horizontal walls of the thick-walled longitudinal parenchyma cells are likewise abundantly pitted.

The *tangential plane* is conspicuous for the extraordinary height and width of the rays, some of which are up to 80 cells high and 4 to 5 cells wide. The minute bordered pits in the walls of the tracheids are disposed in 3 to 4 rows; the pitting is predominantly opposite; the apertures assume the shape of an X.

On the *radial surface*, all the walls of the ray cells are markedly pitted. In the cross fields 5—6—8 minute pits are visible. The pit apertures are vertically oriented. The horizontal walls of the longitudinal parenchyma cells are also thick and pitted.

On the evidence of the ray structure, the structure of this wood resembles, in part, that of the Dicotyledones (e. g., *Quercus*), in part that of the conifers *(Abies)*. Accordingly, it is a homoxylous tree.

In structure, the wood of the living tree is greatly similar to that of *Homoxylon rajmahalense* discovered by SAHNI from the Jurassic. Obviously, its systematic position still awaits clarification.

LARGE-SCALE PROPAGATION OF UNICELLULAR FRESH-WATER ALGAE TO ELIMINATE THE PROTEIN AND FAT DEFICIENCY APPARENT IN FORAGE PRODUCTION IN HUNGARY

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For centuries no attention had been devoted to the algae except by morphologists until in recent years their considerable intrinsic value has been detected. Unicellular fresh-water algae, in particular, have been found conspicuous for their high contents of proteins (50 per cent) and fats (15 per cent), wherefore several countries felt impelled to consider their production on a large-scale. Two trends have developed : industrial production in closed vessels and production in the shallow lakes and ponds along agricultural lines. The preliminary studies ended with favourable results. It was found that by growing unicellular fresh-water algae, from 15 to 70 times as much protein can be produced as the customarily cultivated plants yield in an equal period of time on an area of equal size.

Prompted by these findings the present authors carried out a series of experiments to find out (i) what would be the physiological conditions of a large-scale production of algae in Hungary, and (ii) to predict the crop yields from continuous cultivation provided the conditions could be fulfilled.

No satisfactory vigour of growth in algal cultures can be obtained unless the density of population is successfully kept on an appropriate level, a steady temperature of 15 to 25° C is secured, the cultures are properly aired and mixed, and an energy of light is provided for the algae to build organic substances from the inorganic salts in the nutrient medium. Tne maximum number of cells still showing satisfactory growth is 8000 per cu. mm in the genus *Chlorella*, and 10 000 in the genus *Scenedesmus*. These values attained, the cultures must be diluted to contain not more than 2000 to 3000 cells per cu. mm of the liquid. The cultures are to be tapped about every fourth day ; replenishing the nutritive solution, this time will largely suffice for the cells to regain the highest optimal number, wherely out uninterrupted production is attained. The source of carbon can be CO_2 admixed in a 5 per cent ratio to the air for ventilation. In pond cultures where it is cumbersome to apply doses of carbon in the form of gas, $KHCO_3$ can be used to serve as the source of carbon ; good results were obtained with it in *Scenedesmus* algae in both the laboratory and the field. Glucose stimulates growth even more than CO_2, but saccharose intensifies it only after a certain period of stagnation, probably because of a necessity to produce some kind of an enzyme that dissolves sugar.

The protein synthesis in algae reacts very sensitively to the environmental conditions. for instance, the protein content of algae grown in a liquid devoid of N is about 20 per cent only. The same situation prevails when too dense cultures are maintained in which the cells have ceased to grow in number or have been saturated with light. The intrinsic value of the algal cell finds an expression in the morphological characters of the cell : algae built up from thin-walled small cells of homogeneous plasma are rich in protein, those having thick-walled large cells with vacuoles yield protein poorly. The former are the swiftly dividing and rapidly multiplying forms, the latter the stagnant forms which store up the reserve nutrients (carbohydrates) ; accordingly, only the first are suitable for the production of algal meals of high protein content. Securing for them an adequate supply of N, in these rapidly multiplying cultures it was possible to raise the protein contents to as much as 49,3 per cent.

Under conditions satisfying the biological requirements of the algae, production on a small scale had been kept up for 16 months. The species cultured were *Chlorella vulgaris* BEIJERINCK and *Scenedesmus acuminatus* (LAGERH.) CHOD. Both were grown with the so-called industrial method in closed vessels and yielded excellent results. The latter was also grown in a shallow pond in the open giving an equally good crop.

From 10 to 15 centigram of air-dry algal meal was produced per day and litre of liquid, containing on an average 40 per cent protein and 15 per cent fat. The climatic conditions of Hungary are favourable to production along agricultural lines.

PHYSIOLOGICAL AND BIOCHEMICAL INVESTIGATIONS OF ERGOT OF RYE

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Ergot of rye can be grown in various culture media saprophytically, but without developing a sclerotium or synthesis of alkaloids. It follows that the study of rye and ergot of rye is equally important from the theoretical point of view. Research work extending over four years seems to permit, among others, the following statements. Ergot interferes with the metabolism of the host by means of several toxic substances, of which trimethylamine is one. The physiological effect of the infection is also demonstrable in the leaves of the rye. On comparing this effect with the symptoms seen in germ plants treated with toxin solution, it is found that from the physiological viewpoint the seedling belongs to the resistant type described by RUBIN. Substances protective against antimetabolites can be shown to form in the course of the infection. One of them is ergothioneine, but catalase is likewise probable to be a protector. A number of mono-ascosporic ergot mutants furnished evidence that rye contains substances which are essential to ergot.

Apart from the interrelation of ergot and host plant, the present investigations also embraced questions concerning the physiology of the mycelium and the relationship between contents of alkaloids and pigments.

THE BIOLOGY OF PREDACIOUS FUNGI AND THEIR SIGNIFICANCE IN PLANT PROTECTION

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Equipped with peculiar loops, predacious fungi catch, kill, and utilize as food, live locomotive animals of lower orders, chiefly nematods and amoebae. They occur in several classes of the fungi, and are known since the end of the last century from the work of VORONIN and ZOPF, respectively. These strange fungi were very exhaustively studied by DRECHSLER, who was the first to describe most of the approximately one hundred types known at present.

The predacious fungi live in the soil, in decaying parts of plants, and can be grown in artificial nutrient media.

Since some nematodes do serious damage to cultivated crops, the predacious fungi might be used to advantage in controlling them.

EXPERIMENTS TO DETERMINE DROUGHT RESISTANCE IN FUNGI

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After a review of the history of research work concerned with drought resistance in Fungi, the paper describes experiments which have led to the following conclusions.

1. Despite their most diverse oecological requirements, higher Fungi display the same astonishingly high rate of drought resistance. Of 117 species, respectively varieties, that had been studied, all species have been found to revive after exposure to dryness for 2 months, and half of them after they had been dried for 8 months.

2. Only mycelium which is in contact with the nutritive source is capable of this degree of resistance; if separated from the nutrient medium, its revival is dubious, if not altogether unlikely.

3. On the evidence of microscopic inspection, loss of water is accompanied by decreases in the volume of the cells and changes in their shape.

4. The length of the time for which Fungi have been exposed to drying, does not seem particularly to affect either the rate of revival or the rate of growth after revival.

5. The high degree in which the mycelium is capable of resisting conditions of drought, and the great viability which follows therefrom, establish further proof of the significant part played by the mycelia in the propagation of the species.

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